EIGHTEENTH YEAR

Railway Age

WITH WHICH IS INCORPORATED THE RAILWAY REVIEW

Railway Engineering and Maintenance

DAILY EDITION

FIRST HALF OF 1927—No. 12 CHICAGO—WEDNESDAY, MARCH 9, 1927—NEW YORK SEVENTY-SECOND YEAR

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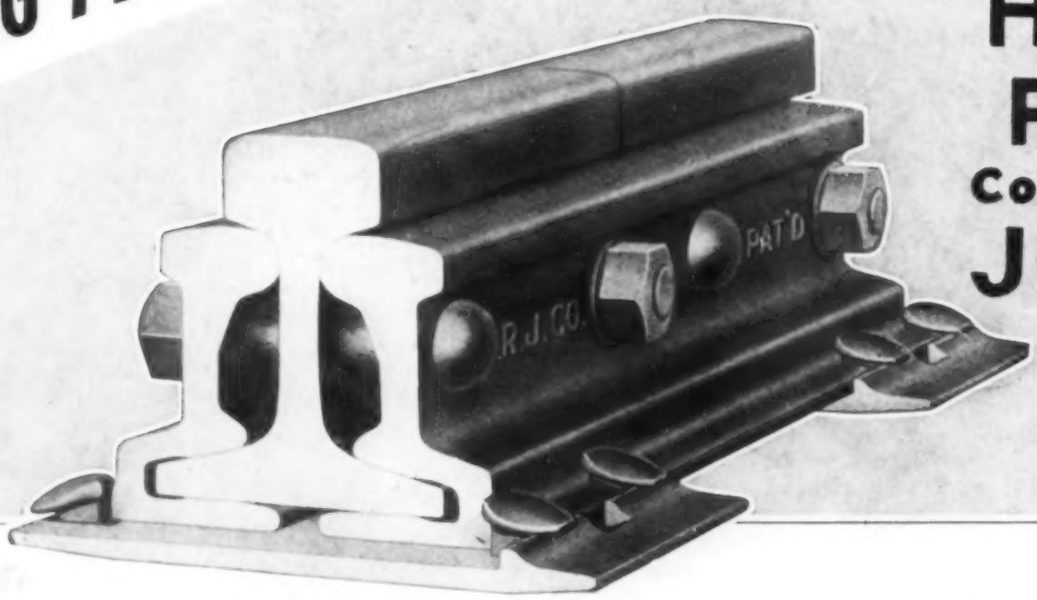

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Railway Age
and
Railway Engineering and Maintenance
DAILY EDITION

Vol. 82 *March 9, 1927* *No. 12*

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Pictures an Innovation in Signal Section Program

DURING the last two years the motion picture camera has been used extensively by amateur photographers as well as by commercial companies. In fact, motion pictures of athletic and social affairs are becoming common. It is said that one picture is ordinarily worth a thousand words of description; therefore 19 pictures a second for half an hour represent a great deal of reading. It is thus logical that engineering associations should be able to use motion pictures to educational advantage. Although the officers of the Signal Section have in some cases frowned on the idea of including motion pictures in the regular program of the convention, it secured two sets of films illustrating the operation of car retarders which were shown during the afternoon session yesterday. The opportunity to see these pictures, and to hear the explanation and the discussion following, gave many members considerable information on this important subject that they otherwise could not have secured. The Illinois Central is extending an invitation to members of the American Railway Engineering Association and the Signal Section, A. R. A., to participate in an inspection trip on Friday over the Chicago terminals and also Markham yard, with its car retarders. This trip will be well worth while but many engineering and signal officers will not be able to remain until Friday. Particularly for these men the motion pictures served an excellent purpose. Their use established a precedent that, if not over-done, may be followed effectively in future programs.

A Need for Action

NO action taken by the A. R. E. A. in recent years has created more of a stir among the members than that yesterday morning in refusing to accept the report presented by the Committee on Records and Accounts in which a reorganization of the Association's program was advocated contemplating the division of the organization into sections. Whether one agrees with the suggestion made or not, he cannot escape the fact that it reflects a growing feeling among the membership that relief must be secured in some way from the pressure for time which is rapidly stifling discussion. It must also be admitted that in making this suggestion and incurring the risk of censure the committee was prompted by a desire to serve the Association and to aid in the solution of this problem. Undoubtedly, the president was justified in ruling that the report was out of order in that it did not come within the scope of any of the assignments given the committee, but the board of direction now has ample evidence that a not inconsiderable portion of the membership feel that the program must be changed and that they may properly expect action from the board this year.

Signal Section Makes Rapid Progress

AN attendance of 751 persons at the annual meeting ing of the Signal Section which closed yesterday afternoon, establishes a new record for that organization, this figure comparing with a maximum previous registration of 680 at the meeting two years ago. These figures offer only one measure of the growth, which is demonstrated in even a more emphatic way by the attendance of 616 at the dinner on Monday night which was much larger than at any of those in earlier years and by the record of increase in membership which was portrayed in graphic form on the large chart that was on display in the foyer. This showed that the membership is now 2,307 or nearly double that at the beginning of 1918 when it totaled 1,191. During the intervening period the annual increase has been as much as 291 and never less than 36. One thing brought out clearly by the chart is that the growth shows no tendency to taper off. There is, therefore, every reason to believe that the Signal section will not exhaust its opportunities for a steady growth for several years to come. One reason for this growth is the fact that the Committee

of Direction has been progressive in assignments for committee work, not only continuing the development of standard designs and practices but also providing for educational material, and of major importance, the collection and presentation of information on the economic factors of signaling.

Results Count

WHEN the Special Committee on Standardization was created by the Board of Direction of the A. R. E. A. in 1919, it was instructed to (1) request appropriate committees to select one or more articles for standardization; and (2) secure the general use by the railroads of the standards and specifications. Since that time the committee has concentrated its attention primarily on the perfecting of an affiliation with the American Engineering Standards Committee with the result that its benefits, measured in relation to its original assignments, leave much to be desired. This year, however, the committee has been reorganized and is trying to make a new start. The report presented yesterday indicated that it will direct its efforts in the future more nearly in accord with its original assignments. The value of a specification or standard must of necessity be measured by the extent to which it is adopted, for the best standard is worthless if it is not followed. A criticism that has been directed against the Railway Engineering Association has been that its members devote a great deal of energy to the development of standards which are presented to and adopted by the Association and are published in its Manual, but that the same members then return to their homes and continue to use their own individual standards. The A. R. E. A. can render no more important service to the railways than to secure the use of common standards for materials and equipment to supersede the wide variety of individual designs now found. For this reason the Standardization committee can perform a most important function and one which deserves the united support of the membership. It must, however, lead the way in the direction that will produce results.

A Specification That Is Making Good

THERE are many subjects about which too much can be said, but on the other hand there are other subjects about which too much cannot be said. An instance of the latter condition is the A. R. E. A. Standard Tie Specification and the value of strict adherence to it by both purchasers and consumers. At this point it is enough to repeat the encouraging note in the report made by the Committee on Ties with reference to the adherence to standard specifications, "The number of roads adhering to standards in their specifications for ties increased during the year." After checking the tie inspection of some five million ties on 12 roads during the year the committee reported further, that so few of the ties examined had been accepted contrary to the requirements of the standard, that it felt amply confirmed in its 1925 conclusions to the effect that ties strictly in accordance with the specifications can be had without additional expense by any road which insists on getting them. A few of the roads on which ties were examined, and many other roads not included in the inspection, still accept under-size and unsound stock, and either do not use the standard size designations or do not mark their ties so as to make apparent the size paid for. We heartily agree with the committee's comment on this situation when it says, "It is incomprehensible why such reckless inspection persists when there is no longer any need for it." Let the educational program go forward. The producers and the roads are bound to fall into line with those who are taking the lead. The sooner this condition exists the better it will be for all concerned.

One Cause of Pumping Joints

PUMPING joints are something for which there should be little excuse, yet the total mileage on which this trouble occurs is quite large. In its report on this subject the Committee on Ballast failed to mention one frequent cause of pumping joints, which is the strengthening of embankments. On an old roadbed where the embankments were narrow originally, or where settlement and wash have made it desirable to apply material for widening, it is the custom of many roadmasters to raise the subgrade across stretches where settlement has occurred, so that when new ballast is applied not so much will be required.

Frequently, the roadmaster who does this knows he is guilty of an improper practice because he is raising the subgrade above the bottom of the existing ballast, but he may not be able to get cinders or porous materials in the required quantities to build up his shoulder at such places, and uses earth or clay to avoid criticism from his superiors for an excessive use of ballast when the track is raised later. Wherever an embankment is built up above the foot of the ballast with other than porous material the proper drainage of the track is interfered with and pumping joints are sure to appear later. It would seem that the committee might well have made specific mention of this practice, which is much more common than it should be, and have warned against it.

Standardization for Automatic Signal Interlockings

DURING the last three or four years marked progress has been made in the installation of so-called automatic interlocking plants for the protection of railroad grade crossings. These plants consist of automatic signals controlled by track circuits, as compared with complete interlocking plants with derails which require the constant attendance of levermen. In 1926, 22 such installations were placed in service in the United States and Canada, bringing the total plants now in service up to about 80 such layouts and at least this many more are planned for installation in the near future. Several roads report that savings in operating expenses of from $4,500 to $6,000 a year are made possible by an automatic signaling interlocking which replaces a mechanical plant where levermen were employed three tricks. In view of the practical operating results and possible savings it is to be expected that numerous other installations will be made in the next few years. The Signal section should therefore take definite action in establishing standards for such layouts.

At the September stated meeting the Committee on Power Interlocking of the Signal section presented two sets of circuits for automatic signaling plants. Following this work the report presented yesterday included a general outline of questions of policy, such as speed limits and the use of push buttons. The use of smash-boards was mentioned but no definite recommendation made as to whether they should or should not be used.

In answer to a recent questionnaire sent by the *Railway Age*, 22 signal engineers out of 28 indicated their opposition to the use of smash-boards, believing them to be an unnecessary complication which would not serve any good purpose in actually preventing accidents. The six engineers who favored smash-boards, however, contended that such a device serves as a means of fixing the blame in case of accident and also secures better observation of signal indications. Definite action regarding the smash-board should be taken by the Signal section as a body. Some states have already established a rule that smash-boards are to be required. If in the opinion of the majority smash-boards are not necessary as a general proposition this conclusion should be established as a guide for the railroads and the railroad commissioners of various states which will be involved in this question.

Field Research for Effective Lightning Protection

COMMITTEE VIII—A-C. Automatic Block Signaling presented an illuminating report yesterday on the subject of lightning protection for overhead and underground signal power lines and control circuits, based upon the klydonograph investigation conducted by the Pennsylvania last summer with the assistance of the research staff of one of the large electrical manufacturers. That its efforts to obtain more useful information on the interesting subject of lightning surges were fruitful is attested by the conclusions reached relative to the best methods to adopt in protecting signal circuits against lighting disturbances. Of particular significance is the evidence contained in the records of the investigation of the 3,300-volt non-shielded underground line which prompted certain conclusions, the most important of which is that "apparently under certain conditions such a line assumes the characteristics of an overhead line and is subject to the same induced potential from a charged cloud."

Continuing, the report referred to the number of breakdowns that occurred where the signal line (underground) was located on a bank above the track level and also to those that were noted where the signal line, although at the track level, were in such a location that a good ground was hard to obtain. Reasoning from these facts the report suggested that "there is in all probability a voltage gradient existing between the surface of the ground and points considerably below it at very many locations."

Reports based upon the results of extensive field research are of the greatest value to the members of the Signal section and it is to be hoped that more committee reports of this nature will be forthcoming in the future. In consequence of this investigation the railroads will be better able to protect their signal lines against the uncertainties of lightning surges. "Because in an underground line, protection to insulation is of the first importance," the report definitely concludes that "lightning arresters should be *distributed rather closely* so that induced voltages * * * may be drained off before the line insulation is punctured." This the committee further amplified by remarking that the *maximum* amount of lightning protection should be afforded on long non-shielded underground lines. It is gratifying to find that this committee has made such commendable progress on the subject of protective equipment for signal lines, which it has been studying consistently for many years.

Announcements

The Annual Dinner

The annual dinner of the A. R. E. A. this evening will be the most largely attended in the history of the Association, more than 1,000 tickets having already been sold last evening, thereby insuring that the facilities of the grand ballroom will be taxed. The speakers will be as follows:

W. G. Bierd, president, Chicago & Alton, Chicago; "Is the Cost of Railway Operation Too High?"

S. E. Winslow, chairman, U. S. Board of Mediation, Washington, D. C.; "The U. S. Board of Mediation."

Rev. Stuart C. Parker, B. D., Minister, St Andrew's Church, Toronto, Ont.; "Cabbages and Kings." Those who have not yet called for their tickets are urged to take them up before noon today in order that there may be no confusion at the last minute. They are in the hands of the Arrangements Committee at the registration desk.

Inspection Trips

Through the courtesy of the Illinois Central an electric train will be furnished for an inspection trip over the electrified zone of that road, which extends to Matteson, Ill., 28 miles from the Chicago terminus, on Friday, March 11. The train will leave the Van Buren street station at 9 a. m. and arrive at the same point on its return trip at 1 p. m. The trip is open to all members and guests of the association and no transportation will be required, but it is requested that those desiring to attend register at the registration desk so that ample accommodations may be provided. A visit will also be made to the new Markham yard of the I. C. where the operation of car retarders in hump switching will be inspected.

Buses for an inspection trip to the Illinois Steel Company's plant at Gary, Ind., and the Universal Portland Cement Company's mill at Buffington will leave the Wabash avenue entrance of the Palmer House at 8:30 a. m. on Friday, March 11, the route including part of the boulevards and parks of the Chicago South Park Board. Luncheon will be served by the Universal Portland Cement Company at its plant at 1 p. m. and the returning buses will reach the Palmer House at 5 p. m.

The A. R. E. A. Program

SECOND DAY—Wednesday, March 9th

Water Service	Bulletin 292
Grade Crossing Design, Protection and Elimination	Bulletin 292
Economics of Railway Labor	Bulletin 292
Economics of Railway Operation	Bulletin 293
Economics of Railway Location	Bulletin 294
Iron and Steel Structures	Bulletin 294
Rail	Bulletin 295
Rules and Organization	Bulletin 293

ANNUAL DINNER 6:30 P. M.

THIRD DAY—Thursday, March 10th

Yards and Terminals	Bulletin 294
Buildings	Bulletin 294
Wooden Bridges and Trestles	Bulletin 293
Wood Preservation	Bulletin 295
Uniform General Contract Forms	Bulletin 293
Masonry	Bulletin 295
Roadway	Bulletin 295
Cooperative Relations with Universities	Bulletin 295
Stresses in Railroad Track	Bulletin 295
Clearances—Progress Report.	
New Business.	
Election and Installation of Officers.	
Adjournment.	

Interior of the Coliseum

Otis E. Hovey, assistant chief engineer of the American Bridge Co., and a member of the Committee on Iron and Steel Structures, has just brought forth the second volume of "Movable Bridges," the first volume of which was published last year.

* * *

C. C. Westfall, engineer of bridges of the Illinois Central, and chairman of the Masonry committee, has as his assistant engineer of bridges on the I. C., Charles Chandler. These two men lived next door to each other as boys at Bushnell, Ill., although there is no record of how many years ago that was.

* * *

William Hood, retired chief engineer of the Southern Pacific, who died during the year, will be remembered as an authority on many engineering subjects, but his other activities are probably not so well known. Mr. Hood was one of the most noted amateur photographers in the country and in addition was an accomplished musician.

* * *

A familiar and well loved figure is missing from the convention this year. Robert Armour, consulting masonry engineer, Canadian National, and a member of the Masonry committee for 14 years, has resigned. His committee has passed a resolution, thanking him for his services in behalf of the committee and the association.

* * *

Who said California? Who mentioned Florida? Who raved about the delights of the Riviera? Chicago greeted the A. R. E. A. with the kind of a day that you read about in the ads for the Mississippi Gulf Coast, but seldom see. Many of the members were heard to express regret that they had not brought their golf sticks along.

* * *

The arrival of R. H. Howard, chief engineer, Wabash, formerly chief engineer of the Chicago & Eastern Illinois, enabled the convention to start. Mr. Howard has attended every convention of the A. R. E. A. since the inception. No convention of that body would be complete without him. A. E. Harvey, chief engineer, Metropolitan Street Railways, Kansas City, is also in attendance and his record is nearly as good as that of Mr. Howard. Mr. Harvey has attended every convention except the one in 1913 when illness prevented his coming.

Some of the bachelor members, and not a few of the married ones who did not bring their wives with them, were observed yesterday wandering around sadly with a reminiscent look in their eyes, thinking, no doubt, of the days when it was possible to stroll through "Peacock Alley" at the Congress and look over the sights. But, if we know them, such members as are interested in the charms of the opposite sex will not be long in finding the Palmer House equivalent of "Peacock Alley."

* * *

W. H. Kirkbride, engineer maintenance of way and structures, Southern Pacific, wears an air of dignity and responsibility this year as is only fitting, since he has probably had more new track turned over to him for maintenance this year than any one else attending the convention. Included in Mr. Kirkbride's new track are the Natron Cut-off, the Southern Pacific's new line in Arizona, and the new second track through the Sierra Nevada mountains. But with all the increased responsibilities Mr. Kirkbride seems to be bearing up well.

* * *

There is a distinct Illinois Central flavor about the association this year. D. J. Brumley, chief engineer, Chicago terminal improvements, is president-elect and a member of the board of direction. Two other I. C. members of the board of direction are L. A. Downs, president, and A. F. Blaess, chief engineer. In addition, there are three I. C. committee chairmen: C. C. Westfall, engineer of bridges, is chairman of the Masonry committee, C. R. Knowles, superintendent of water service, is chairman of the Water Service committee, and J. M. Farrin, special engineer, is chairman of the committee on Economics of Railway Operation.

* * *

The following orders, just received by the Union Switch & Signal Co., will be of interest to signalmen and engineers: The New York, New Haven & Hartford has ordered material for the installation of automatic train stops on its line from Cedar Hill, Conn., to Auburn, R. I., 111 miles; the Pacific Electric has ordered material for automatic train stops to be installed in its subway between Hollywood, Cal., and Glendale, about 200 cars to be equipped; the Norfolk & Western has ordered material for the installation of automatic block signals on its line between Norton, Va., and Bluefield, W. Va., 103 miles; the Chicago Great Western has ordered material for automatic block signals between South Des Moines, Iowa, and Diagonal, 75 miles.

Names Is Names

Chapter II

Continuing the analysis of the names of the members, it is found that there is one block, one bouillon, one Champayne, one Coffey, but only one Drinker and he has only one Barr from which to drink. As to the physical characteristics of the members, there is one Little, one Tallman, one Stout and one Long. The more common colors are well represented, there being 20 Browns, six Whites, two Grays, three Greens and three Blacks. The Irish are out in force, with 51 Mcs, while the Scots can muster only 13 Macs, although there are five Scotts. The Hollanders are represented by 11 Vans and there is only one Holland, not to mention a Poland and an English. The Germans are represented by three Vons.

(To be continued)

The Red Lacquer Room Was Well Filled Throughout the Day

Attendance at A. R. E. A. Convention Breaks all Records

New hall affords ample room for all—Eight reports and two papers presented

ALTHOUGH the Red Lacquer room in the Palmer House, Chicago, offers a larger seating capacity than any other room in which the convention has ever been held, it was well filled when President C. F. W. Felt (chief engineer, A. T. & S. F. System) called the 28th annual convention of the American Railway Engineering Association to order shortly after 9 o'clock yesterday morning. The room was well filled throughout both the morning and afternoon sessions.

Shortly after calling the convention to order, Mr. Felt reviewed the activities of the association during the last year and commented on the progress made. After receiving the reports of the secretary and treasurer, the association then proceeded to the consideration of the reports of standing and special committees including those on Records and Accounts, Shops and Locomotive Terminals, Ballast, Electricity, Standardization, Track, Ties and Signals and Interlocking. In addition, special discussions were presented by J. Den. Macomb, office engineer, Atchison, Topeka & Santa Fe System, on the track recorder developed by that railway for recording the characteristics of railway track and by Dr. Hermann von Schrenk, consulting timber engineer, St. Louis, on the protection of ties against mechanical destruction.

Address by President Felt

Our Association has passed another year successfully. As the bulletins show, the committees have again done a large amount of work and substantially advanced their studies on the subjects assigned to them.

The membership has increased from 2,304 to 2,511 as of March 1, 1927, but I am sorry to report that we have lost 31 members by death, among these being William Hood (charter member), a leading pioneer in Pacific Coast railroad construction; former President W. H. Finley of the Chicago & North Western; President W. R. Scott of the Southern Pacific; President F. E. House of the Duluth & Iron Range; Vice-President G. A. Harwood of the New York Central Lines; and Dean W. G. Raymond of the University of Iowa; also Robert Bell and S. B. Fisher, charter members.

A notable feature of the increased membership has been the very large increase from the Missouri Pacific System, this having amounted to 100 during the past two years. I congratulate those responsible for this and trust that it will spur other organizations on to like activity.

The financial statement for the calendar year ending December 31, 1926, shows an excess of disbursements over receipts of $1,871.52, but we made an extraordinary expenditure during the year for work on the general index, not yet issued, amounting to $2,019.89, and also $3,500 for track plans, of which we have only sold about half; so, considering these special items, our financial statement is quite similar to those of recent years.

Even a casual review of the committee reports for the year must have impressed you with the tremendous ingathering of things we know, but I think the list of the things that we do not know is not less impressive. The latter, however, is not an unhealthy condition. It tends to keep us somewhat humble and shows that we have not yet graduated—that we must still be seekers of the truth and keep at work, and work is the panacea for most of the ills that man, individually or collectively, is heir to.

Many points in these reports should be emphasized, but I can only comment on a few phases of subjects that have been very active with us for many years. The first of these is rail. In addition to the very important element of safety, this is also one of the largest items

of maintenance expense. This still calls for much attention and the continuation of the special research investigations. As indicated, the study of transverse fissures is being carried on actively and the committee has initiated a special investigation for the purpose of developing, if possible, a practical device to detect transverse fissures in rail in track.

The work of the Committee on Stresses in Track has been of considerable benefit by showing how a redistribution of loading on the locomotive axles would considerably reduce the maximum stresses in the rail. The promptness with which the mechanical departments and locomotive manufacturers recognized this in their locomotive design, is a good case of team work among all interested and is very commendable. The improved counterbalancing also reduces the maximum stresses in the rail, and further lightening of the stresses is claimed for the three-cylinder locomotives. Aside from the work of the committee, much investigation is being done by individual companies. A number are also making track tests of rail rolled under various specifications, such as "hot top" ingots and the medium manganese. As indicated, a high quality of rail is so important that a maximum of research is warranted and all roads are urged to co-operate as fully as they may in these investigations. It should also be noted with appreciation that the manufacturers' active interest in the investigations is increasing. The report also illustrates a condition that should be considered in connection with the suggestions that the convention should give the committee reports more discussion and consideration.

Charles F. W. Felt
President

Mr. Felt is a charter member of the Association of which he is now president. He has been chief engineer of the Atchison, Topeka & Santa Fe System since 1913 and has been associated with that property in various capacities for a large part of the 41 years that he has been engaged in railway engineering work. Undisposed to public speaking and of a retiring disposition, he is probably not as well known to the rank and file of the Association as were some of his predecessors but an unfailing kindliness in all his dealings with men has endeared him to those who have had the good fortune to be thrown in contact with him. While few men have devoted their time and energies more exclusively to the interests of their employers, Mr. Felt has willingly participated in outside activities, indicative of which are his service as president of the Chicago Engineers' Club and as an officer of the Western Society of Engineers.

Reference is made to the sub-committee's report of 28 pages on battering. This committee put out a questionnaire of 39 questions and although the number answering was not large, the answers quite fully discuss many phases of the problem; and while there is considerable agreement as to the contributing causes and a remedy (temporary only, perhaps), there is none as to how it may be prevented, with a wide diversity on a number of the points involved, some of which will require further investigation. But if subjects for the decision of the convention are presented as fully as this, and I think the committee reports each year are fuller, it is obvious that not much further discussion is necessary.

A change bearing on this subject is the plan of having the committee organization continuous, so that there will be a minimum of lost time following the close of the association year, and this should result in the earlier issuance of the bulletins during the fall and winter months, so that the members will have sufficient time to digest them before the convention.

Possibly our committees unintentionally are being formed too wholly of "kindred spirits" and that a "contrary-minded" element should be added, so that, where merited, a strong minority report would be forthcoming.

As reports show, the Association is continuing special research work on a number of subjects. All—especially the committee chairmen—are urged to canvass their work for the purpose of finding any other subjects of importance which they believe are worthy of special research work, and bring them to the attention of the Board of Direction.

While proper design and construction are of prime importance, it is also desirable to bring out clearly the economies that will result from the adoption of improved methods. This is illustrated by the report of the Committee on Wood Preservation which includes service test records showing average renewals over a five-year period of less than 120 ties per track mile per year for 3 roads having a total mileage of about 7,800 miles, as against an average of 194 for 25 roads with a total mileage of about 198,000. While it should be noted that this low rate of renewal may not be the most economical for some of the roads, on the other hand, it is likely that further improvement in wood preservation methods will reduce the low average thus far attained.

Incidentally, the reports show an improvement in prescribing tolerances more definitely. Instead of the over-exact "perfect fit" and the indefinite "workmanlike

job," precise limits are given which are of much assistance to all and especially to the inexperienced, and is also important because it tends to reduce inspection differences or disputes with the manufacturer or builder.

The Illinois Central, after extensive investigations and studies, during the past year completed a notable improvement, at a very large expenditure, in the electrification of its suburban service into this city. This is particularly called to the attention of out-of-town members as they may wish to take advantage of the inspection of this project scheduled for 9 o'clock Friday morning.

The attention of all members is particularly called to the exhibit of the National Railway Appliances Association at the Coliseum, to which they cordially invite you. That association has gone to considerable trouble and expense in the gathering and installation of these exhibits and we can best express our appreciation of this by accepting their invitation, which will be of much interest to you in connection with maintenance work.

The able and loyal services of the officers of the Association and of the chairmen and vice-chairmen of the committees and of the membership of the committees are hereby acknowledged. The Association appreciates this very much and thanks you most sincerely. I also wish to make special mention and to expressly thank Secretary E. H. Fritch for the untiring zeal and very able manner in which he has handled his work.

Report of Secretary E. H. Fritch

The activities of the respective committees in the past year have been directed in the following proportions:

Roadway and Track Problems	31 per cent
Structural Problems	25 per cent
Railway Economics	15 per cent
Electrical Problems	15 per cent
Miscellaneous Problems	14 per cent
	100 per cent

Membership

The following table shows the changes in membership during the fiscal year:

Memberships as of March 1, 1926			2,304
Additions during the year	278		
Losses by death	32		
Resignations	37		
Dropped from rolls	20	89	
Net gain		189	189
Total membership as of March 1, 1927			2,511

The addition of one hundred new members during the past two years from the Missouri Pacific deserves special mention. Credit for this gratifying increase is mainly due to the active interest of A. A. Miller, engineer maintenance of way of that company.

Deceased Members

V. S. Abkarian, transitman, Erie.
F. B. Adams, supervisor, Reading.
Victor Angerer, vice-president, Wm. Wharton, Jr., & Co.
Robert Bell, formerly special agent (retired), Pennsylvania (charter member).
Hans Bentele, consulting engineer.
S. D. Cooper, assistant manager, treating plants, Atchison, Topeka & Santa Fe.
A. O. Cunningham, formerly chief engineeer, Wabash.
J. F. S. Donnelly, bridge engineer, Cuba Railway.
D. W. Edwards, civil engineer.
G. H. B. English, supervisor of track, Pennsylvania.
W. H. Finley, formerly president, Chicago & North Western.
S. B. Fisher, formerly chief engineer, Missouri-Kansas-Texas.
B. H. Fowle, Jr., assistant engineer, Virginian.
W. S. Gibson, civil engineer.
H. F. Haag, signal engineer, Kansas City Southern.
G. A. Harwood, vice-president, New York Central Lines.
William Hood, chief engineer (retired), Southern Pacific.
F. E. House, president, Duluth & Iron Range.
J. E. Johnson, division engineer, Pere Marquette.
Phelps Johnson, president, Dominion Bridge Company of Canada.
H. C. Knight, civil engineer.
J. B. Latimer, signal engineer, Chicago, Burlington & Quincy.
R. H. Page, structural engineer, Boston & Albany.
D. E. Pendleton, assistant engineer, Chicago & Western Indiana.
C. D. Perkins, assistant to engineer maintenance of way, New York, New Haven & Hartford.
C. W. P. Ramsey, formerly engineer of construction, Canadian Pacific.
Wm. G. Raymond, dean, College of Applied Science, University of Iowa.
A. V. Redmond, district engineer, Canadian National.
R. B. Robinson, engineer maintenance of way, Union Pacific.
W. L. Rohbock, chief engineer, Wheeling & Lake Erie.
W. R. Scott, president, Southern Pacific Lines in Texas and Louisiana.
Paul B. Tallman, civil engineer.

Publications

In view of the contemplated reprinting of the Manual during the current year, the various committees have made careful examination of their respective chapters and have incorporated in their reports extensive revisions and changes.

The compilation of the references to the contents of the Proceedings has been completed, with the exception of the current year's volume. It is proposed to include the references to Volume 28 in the issue of the General Index.

The 125 plans for frogs, switches, crossings, etc., prepared by the Committee on Track and adopted by the Association, have been assembled and issued in portfolio form.

A number of pamphlets, containing specifications, etc., have also been issued during the year. The demand for the various specifications adopted by the Association is constantly increasing, indcatng a wider appreciation of the Association's work. In 1907 and 1909, the Committee on Iron and Steel Structures made a series of experiments on the effect of moving loads on steel railway bridges, the results being published in a comprehensive report in Bulletin 125, July, 1910. It is gratifying to note that the Railway board of the Government of India has considered this report of such value and importance that it has been reprinted in full as a government publication. The report aggregated approximately 300 pages.

Finances

The following is a summary of receipts and disbursements during the calendar year ending December 31, 1926:

Receipts	$57,043.77
Disbursements	58,915.29
Excess of disbursements over receipts	$ 1,871.52

Extraordinary expenditures incurred on account of printing the portfolio of trackwork plans and the increased volume of other printed matter as well as higher costs are the reasons for the excess of disbursements over receipts.

Miscellaneous

During the past year, a proposal to amend the constitution in regard to the nomination of candidates for vice-president was submitted to letter-ballot of the membership. The proposed amendment requires the nomination of but one candidate for the office of vice-president, instead of two. The result of the letter-ballot was 541 for the amendment and 67 against. More than two-thirds of the votes cast being in the affirmative, the amendment carried and will become effective immediately following the annual convention.

The American Railway Association has appropriated $2,000 for making laboratory experiments to determine the practicability of a device for detecting transverse fissures in steel rails. The experiment will be made under the auspices of the Rail committee.

To enable the Committee on Iron and Steel Structures to complete the experiments on the bearing value of large rollers on bascule bridges, the American Railway Association has provided a fund of $1,500 for the purchase of necessary equipment. The apparatus has been installed at the University of Illinois. We are indebted to L. W.

Baldwin, president of the Missouri Pacific, for securing these two appropriations.

Financial Statement for Calendar Year Ending December 31, 1926

Balance on hand January 1, 1926		$55,614.72
Receipts		
Membership Account		
Entrance Fees	$ 2,240.00	
Dues	23,189.13	
Binding Proceedings and Manual	1,711.05	
Badges	3.00	
Sale of Publications		
Proceedings	3,001.02	
Bulletins	2,169.80	
Manual	856.75	
Specifications	830.00	
Leaflets	218.75	
Track Plans	1,879.25	
Advertising		
Publications	4,801.50	
Interest Account		
Investments	2,217.50	
Bank Balance	184.65	
Annual Meeting		
Sale of Dinner Tickets	3,920.00	
Miscellaneous	63.26	
American Railway Association		
Rail Investigations	9,758.11	
Total		$57,043.77
Disbursements		
Salaries		$11,159.84
Proceedings		6,174.98
Bulletins		13,403.17
General Index		2,019.89
Track Plans		3,500.00
Stationery and Printing		2,079.18
Rents, Light, etc.		845.00
Supplies		459.01
Expressage		705.87
Postage		1,396.53
Exchange		129.58
Committee Expenses		13.40
Officers' Expenses		103.88
Annual Meeting		7,020.37
Refund Dues, etc.		24.50
Audit		150.00
Miscellaneous		291.51
American Railway Assn.—Rail Investigations		9,438.58
Total		$58,915.29
Excess of Disbursements Over Receipts		$ 1,871.52
Balance on hand December 31, 1926		53,743.20
Consisting of:		
Bonds at Cost	$45,785.89	
Cash in S. T. & S. Bank	7,932.31	
Petty Cash Fund	25.00	
	$53,743.20	

Stresses in Track Fund

Balance on hand January 1, 1926	$ 2,109.66
Received from interest during 1926	59.18
Total	$ 2,168.84
Paid out on Audited Vouchers during 1926	255.44
Balance of fund on hand December 31, 1926	$ 1,913.40

Report of the Committee on Ballast

The report of the Committee on Ballast covered four subjects besides a recommended addition to the specifications for washed gravel ballast, now in the Manual. To judge the relative merits of stone from various quarries for ballast will require many tests and the committee recommended that this subject be dropped. The relative values of various kinds of ballast from the standpoint of their effect on operating expenses has only been discussed in a general way by the committee and it reported progress. No new information was developed on the shrinkage of ballast and the committee desired to drop this subject. The causes and remedies of pumping joints were discussed briefly with the recommendation that this subject also be discontinued. J. G. Bloom, the new chairman, has just completed his second year as a member of the committee.

J. G. Bloom
Chairman

THE committee presented a report covering: (1) Revision of the Manual (Appendix A); (2) A method of determining the relative value of stone from various quarries (Appendix B); (3) The relative value from the standpoint of effect on operating expenses of various kinds of ballast (Appendix C); (4) Shrinkage of ballast (Appendix D); and (5) The cause of pumping joints (Appendix E). The committee recommended that the change in the Manual, Appendix A, be approved and that the additional test be inserted in the Manual; that Appendices B, D and E be received as information and these subjects discontinued; and that the subject in Appendix C be continued for further study.

Committee: J. G. Bloom (C. R. I. & P.), chairman; Paul Hamilton (C. C. C. & St. L.), vice-chairman; L. L. Adams (L. & N.), G. J. Bell (A. T. & S. F.), T. S. Bond (I.-G. N.), Paul Chipman (P. M), H. R. Clarke (C. B. & Q.), C. J. Coon (N. Y. C.), C. E. Dare (R. F. & P.), F. T. Darrow (C. B. & Q.), R. C. Dunlay (M.-K.-T.), J. L. Gonzales, K. H. Hanger (M.-K.-T.), W. S. Hanley (St. L. S. W.), A. G. Holt (C. M. & St. P.), H. N. Huntsman (Wab.), A. R. Jones (N. Y. C.), S. A. Jordan (B. & O.), W. J. H. Manning (D. & H.), W. A. Roderick (W. & L. E.), E. I. Rogers (P. & P. U.), C. B. Stanton (Carnegie Inst. Tech.), C. E. Weaver (C. of Ga.), P. H. Winchester (N. Y. C.), A. H. Woerner (B. & O.).

Appendix A—Revision of Manual

The committee proposed the following test be added to the Specifications for Washed Gravel Ballast, which were adopted at the 1926 convention:

TEST NO. 4—PROPORTION OF AGGREGATES IN WASHED, CRUSHED AND SCREENED GRAVEL

A sample of the prepared ballast weighing not less than 150 lb. shall be thoroughly dried, weighed and placed on a screen having holes 1½ in. in diameter; all material which can be passed through this screen shall be placed upon a screen having holes 1 in. in diameter; all material which can be passed through this screen shall be placed upon a screen having holes ½ in. in diameter; all material which can be passed through this screen shall be placed upon a screen having meshes of ¼ in., and all material which can be passed through this screen shall be placed upon a No. 10 screen, and all material which can be, shall be passed through it.

If the ratio of the amount of material retained on the 1½ in. screen to the amount of the sample as a whole exceeds two per cent, the product shall be rejected until the fault has been corrected.

If the ratio of the amount of material passing the No. 10 screen to the amount of the sample as a whole exceeds three per cent, the product shall be rejected until the fault has been corrected.

If the ratio of the amount of material retained on each of the screens to the amount of the sample as a whole does not come within the tolerances given above, the material shall be rejected until the fault has been corrected.

Appendix B—Relative Value of Stone as Ballast from Various Quarries

The committee felt that at present there is not enough data, on ballast of proven merit, to establish any equating coefficients or other arbitrary values whereby one ballast may be given a higher numerical index than another.

To establish a standard as to absorption, hardness, toughness and wear would require a large number of tests of ballast of proven merit. Such a standard would seldom be of service, as the choice between usable materials is generally limited by length of haul, and totally unfit sources have been eliminated by experience.

The committee was, therefore, of the opinion that the benefits to be derived will not justify the expenditure necessary to make sufficient tests to obtain data upon which to base conclusions on the topic assigned.

Appendix D—Shrinkage of Ballast

At the 1924 convention the committee made certain recommendations relative to the shrinkage of ballast which were adopted for insertion in the Manual. With a view to determining to what extent this information was being used by members of the association a questionnaire was prepared and sent to members of the association. The committee received 64 replies, 13 of which report a percentage of shrinkage on certain ballast. In view of the fact that no information was received which is in conflict with the matter now in the Manual the committee recommended that this subject be discontinued.

Appendix E—Pumping Joints

The causes and remedy of pumping joints as found by the committee were: (1) Water pockets in the roadbed, so located as to hold water close to the surface of the ground; (2) foul ballast, either from mud and water working up from underneath, or dirt allowed to fall on the ballast from the top in ditching or other work; (3) creeping rail and battered joints, either moving the joint ties, or hammering them down.

The only remedy for the first cause is the removal of the water pockets. This can be done by ribbing with rock where the trouble is on fills, or laying drain tile where it is in cuts, using parallel drains and laterals where needed. If drain tile is laid, it will be necessary to clean out all of the old ballast that has become foul, and substitute new material.

Where the ballast has become foul so as to hold the surface water it will be necessary to clean out the old ballast and raise the track on fresh material.

Where the joint ties are spiked in slots on rail joints, and the rail creeps, it will, of course, move the joint ties from their original bed, and this will soon cause the joint ties to start moving, which action will pump the water from underneath the ballast to the surface, causing sloppy track, and where the rail has bad joints from loose bolts or lipped rail, it will have the same effect. This can be remedied by properly anchoring the track with anti-rail creepers, and removing the defective rail, being careful to see that all bolts are tight at all times.

Discussion

[The report of the Committee on Ballast was presented by the chairman, J. G. Bloom (C. R. I. & P.) with Past President L. A. Downs (I. C.) presiding over the session. *A motion was made to adopt Appendix A for inclusion in the Manual.*]

R. H. Ford (C. R. I. & P.): I assume that the committee, although it gives no reason for it, wants to add one additional test to that now shown in the Manual under ballast. Of course, we know there have been a great many changes brought about by the good roads movement and other things that have brought more clearly into view the better understanding of our ballast, and I am just inquiring if the purpose is to make it a little more definite and precise than what the present tests call for.

Chairman Bloom: The purpose is to get the proper proportions in the car when loading at the plant so that the car will not all be loaded with the coarse material or all with the fine. [*The motion to adopt Appendix A was carried following which Appendix B was presented.*]

Mr. Ford: Do I understand that the committee feels that a poor stone that is nearby and for which there is no proper information concerning durability is preferable to a better stone hauled many miles if necessary because of its durability? If that is the case, the engineers of one of the western lines that has made a particularly long haul for its material because they felt justified I believe would take issue with that report. I think the committee is wrong. I think the question of durability itself is very, very essential to the type of ballast used. I think a railroad is justified, if necessary, in hauling ballast long distances if by so doing it can secure the best and most desirable material.

The Chairman: The committee offers the opinion that the benefits to be derived will not justify the expenditure necessary to make sufficient tests to obtain data upon which to base conclusions on the topic assigned.

W. C. Cushing (Penna.): I also disagree with the conclusion of the sub-committee for much the same reason. It is very desirable to have a gage which can be used in the study of the value of a quarry that is in the district of the railroad and available for use. If it is possible to evolve a formula of the kind mentioned, it would be an exceedingly profitable piece of work.

C. B. Stanton (Carnegie Institute): In answer to Mr. Ford and Mr. Cushing, I believe that tests can be made to determine the value of a ballast. I have been doing some research work to find out what tests would give us the results that we want from ballast. From some of the Deval tests I have found as high as 60

per cent of the detritus adheres either to the walls of the cylinder in which it is made or else to the ballast itself. In order to eliminate that, we have made a head for the Deval machine, which eliminates the detritus and as a result we get an entirely different story from our ballast experiments from what we do with the ordinary Deval test.

Another thing we have taken into consideration is the study of the action of the ballast in water. The same test is run with the ballast covered with water, and some ballasts show a material increase in wear when given this same test subject to a slight amount of water, or rather three to five pints of water in the machine, and we are getting some very interesting experiments. [*A motion to refer the report back to the committee for further study was carried.*]

Professor Stanton: Of course the committee has power to act, but does not have the substance wherewith to act so far.

C. W. Baldridge (A. T. & S. F.): I believe if this committee will search diligently enough it will find that a great many tests have been made which will be available at least in part. It is very important that we make a study of some means of determining when we have the best ballast that is available.

Professor Stanton: In answer to Mr. Baldridge; within the last two years we have studied this, and we have gotten all the available data that we could, especially from the Bureau of Roads. We have taken some 500 of their tests and plotted them, for absorption, wear, hardness and toughness, against weight and against each different element. We are unable to strike a definite curve to show us anything in particular, because practically all the tests that have been conducted heretofore have been along the line of highway tests. We have never branched out into tests of our own. This experimental work that I have done personally has been on material for ballast.

The New York Central and the Big Four have furnished us some samples of limestone, and the P. & L. E. has furnished us some samples of slag. We are washing it thoroughly, drying it and giving it a sieve analysis and refusing everything that passes a ⅜-in. screen. Then we give it the usual Deval test, with the open head on our machine, and catch the detritus. That ballast is then washed and a sieve analysis made to find out what went on in the ballast as it came to us.

A very striking thing we get there as compared to the Deval is the fact that with the Deval, 95 per cent, say, of the detritus will pass a 48-mesh sieve. With the open-headed machine we get about 40 per cent that is retained on the 48-mesh sieve, and the rest of it goes through. When we come to the test in water, that is, grinding the ballast in water, as high as 99 per cent of the detritus passes through the 48-mesh sieve. Whether that has any influence on pumping joints, we don't know, but we are interested in taking some of the material from a pumping joint, drying it out and running a sieve analysis on it, to find if it isn't the same thing we get by our tests in water.

Hunter McDonald (N. C. & St. L.): I have given considerable attention to the quality of ballast and to the effect that it has on pumping joints. I took some limestone powder from the track and found it would pull 80 lb. in a test. It had a tendency to cement. That cementing quality is an objectionable feature of any ballast.

I want to suggest also to the committee a line of research that would be worth while, and that is to analyze the mud chemically as well as by the sieve. I made a chemical analysis of some of the mud that was pumped up and found 16 per cent of carbon in it, but a very low percentage of limestone. I think that the ballast which is composed of flint or gravel is far superior to any limestone ballast. I believe the committee has a line of research there that is well worth while.

W. H. Kirkbride (S. P.): I feel with the other speakers that this is a very important subject that should not be dismissed. The railroads want some constructive rules and advice that will enable them to study their own particular problem.

I do believe this subject can be studied by possibly following this line of procedure: Issue a questionnaire to the railroads, to obtain specific information as to the kind and qualities of ballast that they use; to define the exact rock that is being talked about; to obtain experience as to serviceability and workability in track; and to obtain any physical or chemical tests that they may have made. When all of that information is assembled from the various roads I feel sure that the committee will have some constructive information which can be compiled.

J. C. Irwin (B. & A.): I join in the opinion expressed by Mr. Ford and Mr. Cushing and others in regard to the value of further investigation on these lines.

The ballast as a whole on the Boston & Albany is trap rock and I have been impressed with the fact that the use of trap rock ballast is very much more economical than that of limestone. As the wheel load is increasing and traffic becomes heavier, I think a great deal can be done towards effecting a saving by the use of the hardest ballast available within a reasonable haul. [*The motion to refer the report back to the committee was put and carried.*]

[Chairman Bloom recommended that Appendix C, Relative Value, from Standpoint of Effect on Operating Expenses, of Various Kinds of Ballast be continued for further study and it was so ordered. He then introduced E. I. Rogers (P. & P. U.), chairman of the Sub-committee on Shrinkage of Ballast. Mr. Rogers submitted the matter in Appendix D as information.]

H. E. Hale (Presidents' Conference Committee): We have in the valuation work made a good deal of measurements to determine the correct shrinkage of ballast. Our figures are slightly in excess of those printed here. We had a great deal of difficulty finding places where we could actually measure the exact quantities paid for, for that track. I am wondering if the committee has been able to find such places and has actually measured the amount of shrinkage from the place quantities to that which is found in track.

Mr. Rogers: I believe I can answer that in this way: I took the precaution to read what was considered the definition of shrinkage of ballast as in the original report and the committee is not attempting to deal with the amount of ballast that it will take to bring a railroad track back to an established sub-grade line at any point after it has had traffic on it. This shrinkage that we are dealing in here and which has been dealt in heretofore, is the amount of shrinkage that should be added to the cars at the pit as measured to bring the ballast on the final grade line as it gets ready for final traffic up to that grade line and we have not attempted to go into the way of establishing how much ballast has shrunk in place.

Mr. Ford: I think, however, there is one point that the sub-committee has failed to recognize. There is a direct connection between the shrinkage of ballast as determined in the track and while it is at the pit, and

irrespective of the difference which the Chairman has suggested the fact remains that with the differences as indicated by Mr. Hale it leaves a confusion in the minds of the railroads concerning this very important question of the shrinkage of ballast.

I think the information given by the committee is valuable. At the same time I hope it will see its way clear to continue this study and tie up with the Hale studies on ballast shrinkage.

Mr. Hale: I would like to urge that the committee determine the total shrinkage from the place quantity to the condition in track after the track is completed and in service. The amount of it was quite surprising to us. We finally found the reason was in the place quantity not being compacted as nature has it. Therefore the shrinkage of ballast is very much in excess of the ordinary shrinkage of earth taken from its natural bed to its bed under the ties. You took the ballast from a dumped-loose-in-the-car condition which is quite swelled in the natural bed down to the bed under the track and the percentage is quite remarkable.

J. L. Campbell (S. P.): As I understand the explanation given by the chairman of the sub-committee it appears to me that these figures of shrinkage are not the figures that are required for a correct determination of the amount of place quantities of ballast which went into the track for the purpose of valuation. The matter is of a great deal of interest to the railroads. As I understand what he said, it is that this shrinkage includes that which takes place up to the time the ballasted track is finished and turned over to operation. I am sure that there is an additional shrinkage of ballast after that and that in the course of a few years there is a further shrinkage, and it is that shrinkage that we ought to have for valuation purposes.

Mr. McDonald: It has been an idea of mine that the percentages that you allow at the time the car is loaded may be proper, but it largely depends on the distance and the condition of the track over which it is hauled. I believe when it gets to the end of the haul and is unloaded again that the original condition at the time of loading is restored through the unloading.

S. E. Coombs (N. Y. C.): Mr. McDonald has stolen some of my thunder. I had in mind an experience I had in a long haul of stone ballast which was piled off on the track and left about four days before it was tamped and then tamped by hand.

The shrinkage was very much less with that ballast that was not tamped quickly on account of the action of the trains. Now we are using a lot of air tampers and of course they are tamping the stone very much more compact, and that is another element.

H. L. Ripley (N. Y. N. H. & H.): From what has been said I am afraid somebody may go away with the impression that this 9.3 per cent shrinkage in stone ballast is the total shrinkage that takes place in the stone ballast as between when loading on the cars and that found in the track. I think the discussion simply should be made clear that this 9.3 per cent has no relation whatever to the amount of shrinkage figured by the Bureau of Valuation in their work in connection with the federal valuation of railroads. What they do, as a matter of fact, is take the ballast which they find in the track already shrunk. Then they add 10 per cent to that shrunk ballast that has been pounded down under traffic so that the total shrinkage in stone ballast as between the time when it is loaded on the car and in the ballasted section as you find it in your finished railroad is from 14 to 17 per cent instead of 9.3 per cent, and the experiments I made bear that out completely.

Mr. Ripley: *I move that the matter be referred back to the committee, and if it is proper that they be instructed to develop this second stage of shrinkage.* [*The motion was carried.*]

[Appendix E on the cause of pumping joints was presented by W. S. Hanley (St. L. S. W.), chairman of the sub-committee.]

G. D. Brooke (C. & O.): In the three reasons given for pumping track I find that the committee has entirely neglected the fouling of ballast by the destruction of the ballast.

Mr. Hanley: If the ballast disintegrated from hammering joints the ballast is foul and interferes with the drain.

Mr. McDonald: I once heard Mr. Stevens of the Reading state before this convention that sparks from the locomotive would foul ballast in two years.

Mr. Brooke: I would like to ask if the last remarks of Mr. Hanley are incorporated in these reasons.

Mr. Hanley: You might interpret that as covered by the word "foul." Disintegrated ballast is certainly foul ballast. It interferes with drainage and this is a drainage condition.

W. H. Kirkbride (S. P.): The committee in its conclusion suggests that the sub-committee on joints be discontinued. It would be a happy thing if we could also discontinue the pumping joints. I don't think we can and I would like to see this study continued because while the work of the committee is thus far commendable I do not believe it has exhausted the subject.

Maurice Coburn (Penna.): There are one or two other points. It seems to me that the question of spiking the slots is much more important on a single track than on double track because on the single track the tie moves back and forth. We have cured many pumping joints by taking the spikes out of the slots. Some of our track men tell us that if you can put a spike in skewed so that when the rail moves up and down the tie moves with it you are almost sure to have a pumping joint under the gravel ballast. [*There being no further discussion the committee was excused.*]

Reballasted Track Near Tennessee Pass on the Main Line of the Denver & Rio Grande Western

Report on Shops and Locomotive Terminals

The Committee on Shops and Locomotive Terminals confined its report to storehouses for shops and locomotive terminals and to the storage and distribution of fuel oil. Last year the first subject was presented for discussion and suggestion, while this year the report was submitted for adoption and printing in the Manual. This part of the report went into details regarding layouts and the construction of these facilities. The matter presented on the second subject dealt with the question of fire hazard attending the storage of fuel oil and included discussions of dike protection around oil storage tanks and the most desirable types of tank roof construction consistent with economy. The report contained papers on these subjects by two members of the committee. F. E. Morrow, has been chairman of the committee since it was organized in 1920.

F. E. Morrow
Chairman

THE COMMITTEE presented a report covering the following subjects: (1) Storehouses for shops and locomotive terminals (Appendix A); and (2) Typical layouts for storage and distribution of fuel oil (Appendix B). It recommended that the conclusions in Appendix A relating to storehouses for shops and locomotive terminals be approved for publication in the Manual and that conclusion No. 7 now appearing in the Manual, relating to typical layouts for storage and distribution of fuel oil including fuel oil stations between terminals, be amplified by the addition recommended in Appendix B.

Committee: F. E. Morrow (C. & W. I.), chairman; A. T. Hawk (C. R. I. & P.), vice-chairman; C. I. Anderson (I. C.), A. L. Atwill (C. & W. I.), C. N. Bainbridge (C. M. & St. P.), Leland Clapper (D. & I. R.), N. Corey (I.-G. N.), J. W. Dansey (A. T. & S. F.), K. B. Duncan (G. C. & S. F.), R. J. Hammond (B. & M.), Geo. W. Hand (C. & N. W.), G. W. Harris (A. T. & S. F.), J. L. Haugh (U. P.), L. P. Kimball (B. & O.), W. H. Kirkbride (S. P), W. T. Krausch (C. B. & Q.), H. C. Lorenz (C. C. C. & St. L.), H. M. Lull (S. P.), R. A. Marshall (D. P. Robinson & Co.), J. S. McBride (C. & E. I.), J. M. Metcalf (M.-K.-T.), G. A. Noren (N. Y. C.), D. A. Porter (S. P.), V. B. W. Poulsen (C. & O.), W. A. Radspinner (C. & O.), J. W. Raitt (N. & W.), L. K. Sillcox (C. M. & St. P.), John Schofield (C. N. R.), B. S. Voorhees (N. Y. C.), H. W. Williams (C. M. & St. P.), A. M. Zabriskie (C. of N. J.).

Appendix A—Storehouses for Shops and Locomotive Terminals

Last year the committee submitted a progress report for the purpose of eliciting discussion and suggestions; as a result the committee offered a number of conclusions which were recommended for adoption and publication in the Manual.

Conclusions

General—1. In practice very often the storehouse for these facilities is combined with the system district or division storehouse, and even when this is not the case the storehouse may serve several shop and terminal facilities. In view of these conditions only the most general requirements can be given, as the size and location will be governed by the services required.

2. The subject of storehouses is taken to include not only the storehouse proper but all auxiliary facilities consisting of sub-storehouses, oil storage, material platforms, paint stores, lumber storage yard and sheds, material racks, sheds for coal, coke, charcoal, fire brick, locomotive arch brick, storage for generating of oxygen and acetylene, scrap dock and reclamation sheds, etc. Sub-storehouses for shops and terminals are not necessary where the store delivery is in operation.

Location—3. The location of storehouses and their auxiliary facilities, such as switching tracks, etc., must be given due consideration by all departments concerned, with reference to loading and unloading of cars, switching, delivery of material to users, the possibility of future expansion, the type and extent of roadway and equipment to be used in handling material.

Tracks and Roadways—4. Track facilities should be provided for the receipt of incoming materials, for the loading out of material, for distribution to other points and shipment of scrap.

5. Paved roadways should connect the storehouse with public highways and all parts of the shops and terminal served by the storehouse. These roadways should not only be provided to serve in the distribution of materials but should also provide easy access for fire apparatus, including sufficient space at hydrants for manipulating equipment.

These roadways should be 18 ft. wide leading to all fire hydrants, should never be blocked and should have signs properly posted; in all cases quick access should be provided for the city fire department.

Construction—6. Storehouses wherever possible should be one story and all should be built of fireproof construction, except perhaps small auxiliary buildings. Metal buildings may be used for the small auxiliary buildings where fireproofing is of importance, but the difficulty of heating this type must be considered.

Interior columns should be avoided in one story buildings. In buildings of more than one story care should be taken that posts and racks are so spaced, to provide maximum storage, with least interference.

Main Storehouse

Arrangement—7. The primary consideration is the economical handling of material. The arrangement should be such as to insure ample natural light, the convenient handling, checking and inventorying of materials, and ease of supervision. In order to reduce cost of construction, storehouse floor and platform may be placed practically at the track or ground level with raised platform and ramp for unloading to and from cars. Racks should be so located that the handling of

materials will be reduced to a minimum and so that there will be no dark pockets for the accumulation of rubbish. Main aisles of ample width should be provided to allow for the handling of material by motor truck.

Arrangement of Racks—8. The most general practice is to place the racks transverse to the house, thus permitting natural light from side windows to illuminate the aisles and racks. Some railroads place the racks longitudinal to the house to permit freer observation of the force. On the other hand, this arrangement requires more artificial lighting and more floor space.

In larger storehouses the arrangement of racks and aisles should be such that electric tractors and trailers may be used in handling heavy material from one part of the store building to another.

The relative location of racks and windows may have a material bearing on the possibilities for fighting fires. Fire brigades frequently cannot enter a burning building but must direct the hose stream through windows from outside.

Number of Stories—9. A one story house possesses advantages for easy and short trucking but where a very large floor area is required a two or three story building is more suitable. The question of multiple stories should also be dependent upon the availability and value of ground space. Where more than one story is used the upper floors are used for offices (at one end), slow moving and light materials and for an assembling place for work requiring the holding of material until it is assembled for a complete job.

Floor Loading—10. Upper floors should be designed for a live load of not less than 250 lb. per square foot. The first floor, if built over a basement, should be designed for a minimum live load of not less than 400 lb. per square foot.

Elevators—11. In multi-story buildings, elevators of at least four tons capacity should be provided. For larger houses one elevator should be provided for each 20,000 square feet of floor area served. These elevators should be of sufficient size and capacity to handle an electric truck and trailer. The self-leveling type of automatic elevator with push button control is desirable. Floor openings act as flues to promote draught during a fire and should, therefore, be thoroughly enclosed. Entrance doors must be normally closed or be provided with fusible links to assure that they will close during a fire.

Ramps—12. Instead of elevators, ramps inside of building, to accommodate electric trucks, have, in some instances, been found more efficient.

Chutes and Conveyors—13. Package chutes from upper floors to the lower floor are very convenient in the larger sized stores and should be located near the elevator. In some cases a dumb waiter will answer the same purpose as the chute. Portable conveyor systems are very handy for handling and piling material that has only to be handled a short distance, and should be part of the equipment of the larger sized storehouses.

Lighting—14. Electric lighting should be provided, with the lamps over the aisles and plug outlets at ends of the racks. The circuits should be arranged and controlled so that only the lights actually needed will be turned on.

Ventilation—15. Ventilation should be given careful study, and the main storage part of storehouse, as well as the office portion, should be well ventilated so that working conditions will be as near perfect as possible. Much of the material stored, especially electrical material, rubber goods, hose and packing, should be kept where it is dry and the heat and ventilation should be arranged accordingly for it.

Heating—16. Heating should be provided for the office, stock, and workroom sections, the latter at a less temperature than the former. Storerooms should be heated so that it is comfortable for the laborers to work in any part of them without wearing clothing that hampers them in their work. A temperature of 72 deg. for the office section and 60 deg. for the storeroom sections is recommended. If reducing valves are necessary on high pressure lines they should be of such type and so located as to be free from possibilities of tampering.

Office—17. The office should be of sufficient size to accommodate the help, allowing a minimum of 64 sq. ft. for each clerk, together with space for files and a separate office for the storekeeper and in some cases for a general foreman. Where desirable to consolidate forces, they should also share office space with the master mechanic, the medical organization and others. In one story buildings the office should be at the end of the storehouse. Where there is a scarcity of floor space available it may be desirable in a one story building to place the office section on the second floor, in which event the end wall of this second story section, facing the roof of the one story part, should be constructed either without windows or, if with windows, these should be fire-resisting. In buildings of two or more stories the office should be at the end of the second floor. If so placed, a fire wall should be erected to serve effectually as a cut off between the two sections of the building.

Toilet Facilities—18. Toilet facilities are usually regulated by governmental requirements, but in any event adequate toilet and wash room facilities should be made for both office force and for storehouse laborers. Where women are employed a rest room should also be provided.

Racks—19. The open type of racks, of either wood or steel or other fireproof material, with adjustable shelves, adapts itself better to the unit piling of material, and is recommended. Racks with one or two offsets are in common use, with the base approximately five feet wide in the case of one offset and approximately six feet wide in the case of two, the upper section of the rack being usually about three feet wide, the offset affording a step to reach the upper shelf easily, which in all cases should be in plain view of a man standing on offset. Metal racks without offset will afford closer spacing and are more flexible, and as they reduce the amount of combustible material, materially reduce the fire hazard. They should be of such height that the upper shelf is in full view of a man standing on the floor. In no case should racks be contemplated requiring the use of a ladder to reach the upper shelf.

Platforms—20. Concrete platforms should be provided on the side track along the entire length of storehouses, and where motor trucks with trailer trucks are used they should be equipped with rubber tires, and a 14-ft. wide platform is recommended. All platforms should have ramps at the ends.

Fire Protection—21. An adequate interior automatic sprinkler system should be provided, if warranted, the next choice for protecting the inside of the building being water pipe lines, with hydrants and hose reels. A sufficient number of fire hydrants with hose cart protection should also be installed outside of the building. Regulation fire extinguishers should be distributed

through the store buildings in accessible and plainly marked locations. Fire alarm boxes, where warranted, should be located at convenient points both within and without the stores. The location of all hydrants, hose reels, extinguishers, alarm boxes, etc., should be such that they can be plainly seen in day time, and well illuminated at night by electric lights.

Yard Cranes

22. Casting platform at large shops should have an overhead traveling crane the entire length of the casting platform. This crane should also cover the track or tracks serving the platform, so as to reduce to a minimum the handling of the castings from car to platform. At small terminals locomotive crane or other self-propelled type may be used for this purpose.

Casting Storage

Iron Racks, Pipe Racks and Platforms—23. Local conditions will govern the location. They should, however, be located so as to reduce the handling from the car to storage and from storage to where they are used, to a minimum. Castings and other heavy bulky material should be stored on open platforms and at large shops under traveling crane. Where sheet iron is stored, all sheets larger than No. 10 may be stored outside except where climatic conditions prevent. These should be stored on edge in racks made of steel posts with the bottom ends embedded in concrete piers, unless they are to be handled by magnet and crane, then they should be stored flat.

If ground space permits tank and fire box steel should be stored adjacent to the shop that will use the material. These racks should then be provided with overhead mono-rail that will economically handle the material into the shop.

Platforms should be designed for a live load of not less than 800 lb. per square foot.

Oil House

Location—24. The oil house, with tracks and switching facilities, should be at one end of and separated from the storehouse a distance of not less than 50 ft. Oil storage should be in the basement and the first floor used for delivery counter, pumps, oil drums, waste and similar material. Oil tank and piping in the basement should be painted white, to lighten up the basement and to readily show any leak that may occur.

For small stores, oil may be stored in a basement under one end of the storehouse with counter pumps, oil drums and waste on the first floor. The oil house portion should be separated from the storehouse by a fire wall.

Construction—25. Oil houses should be built of fire resistive materials, including steel sash and wire glass with self closing device on fusible links. Tanks of sufficient capacity should be provided in the basement, except for gasoline and other high flash oils, which should be located outside, with the tanks placed underground. Fuel oil storage tanks should be located outside and may be buried or placed above ground as local conditions warrant. Suitable provision should be made in the building construction to permit the removal of any tank in the basement.

Pumps—26. Self measuring pumps are recommended for handling the oil that is stored in the basement of the oil house. These should be located on the first floor of the oil house. There are on the market a number of the enclosed type of pumps that are economical and efficient. In no case should pitcher pumps or a pump that leaks oil around the pistons or delivery spout be used.

For the outside tanks and where volume of oils stored in the basement justifies consideration should be given to the handling from tank to delivery counter by air. In such cases, small auxiliary reservoirs should be placed directly in front of the large tanks, the oil being fed into these small reservoirs by gravity through a check valve, thus preventing the application of air to the large tank.

Waste—27. Sufficient space, preferably separated from the oil room by fire-resistive partitions in which openings are protected by automatic self closing fire doors, should be provided in the oil house for storage of waste. Provision should be made so that broken packages and loose waste be kept in metal boxes with weighted covers held in open position with a fusible chain which will close cover in case of fire.

Where it is necessary to maintain mixing vats in oil house and the machinery for reclaiming grease, a separate room should be provided for this purpose; entrance from any adjacent room should be protected by automatic fire doors. If of an extent, separate building should be provided.

Fire Protection—28. An ample supply of foam extinguishers must be maintained for fire protection. Vapor-proof lamps controlled by an outside switch should be used. A barrage steam system should be installed with the added protection of sand in barrels and pails, the latter principally for small fires.

Paint Stores

Location—29. Wherever possible, this building should be part of the oil house, and where not possible, a fireproof building should be provided, located conveniently to paint shop. The shelving bins in the paint house should be of steel or other non-combustible material. Where the paint store is a part of the oil house it should be separated from the oil storage portion with a fire wall in which are no openings.

Lumber Shed

Location—30. These should be located in the material yard with sufficient tracks so that switching and handling may be reduced to the minimum.

Construction—31. They may be of frame construction and of sufficient size to keep protected all inside finished lumber. These sheds are usually built enclosed on three sides with one side partly open, next to the track where the lumber is received in cars, and this open side should be sufficiently high so as not to interfere with the handling of the lumber between the car and the stacked lumber inside of the building.

In order to protect the lumber stored on the open side of shed, the roof is given either a wide projection or the top side is skirted down to the line of the top of lumber piles. Lumber should be piled off the ground and it is sometimes found a good practice to store lumber piles on second-hand rails supported by small concrete piers about 12 or 18 in. above the ground. The sides and rear of the shed are usually made of one inch boards with an inch space between them to allow for ventilation. This siding should not extend below the top of piers.

Scrap Yard Facilities

32. Ample space should be provided for handy unloading, sorting and classifying of scrap so as to obtain the greatest possible classification of the various grades and corresponding advantage of price in the sale thereof. Scrap yard and reclamation plant should be so

located as to necessitate the minimum possible handling and trucking of material between these two units of a storehouse.

MISCELLANEOUS

33. Torpedoes and fuses should be stored preferably in main building in a place segregated from regular storehouse material, with adequate provision for excluding moisture and for fire proofing the compartment.

34. Coal, coke, charcoal bin or sheds should be located and so constructed as to permit of unloading direct from car and close to place where the material is to be used. At large storehouses these units of the facility should allow for unloading of these materials from cars to shed or bins by clam shell or crane.

35. Oxygen and acetylene should be stored in a separate building of light frame work construction, located not less than 50 ft. from main building.

36. Fire brick and fire clay locomotive arch brick should be stored in weather-tight sheds as close to place where material is to be used as possible.

Appendix B—Typical Layouts for Storage and Distribution of Fuel Oils

In view of the developments and studies relating to dike protection around oil storage tanks the committee continued its study of this subject. Different views had been expressed as to the desirable roof construction for oil tanks. Therefore, the committee presented as information a discussion of each of these subjects by two members of the committee.

In his discussion of fire wall and dike protection for oil tanks W. H. Kirkbride (S. P.), reviewed a number of disastrous oil tank fires and said in part: "The boilover hazard involved in heavy oil fires makes it particularly dangerous for fire fighters to remain in the vicinity. The fact that light oils burn within their containers is likely to lead to the belief that heavy oils will do likewise, particularly since the fire burns for several hours before a boilover occurs. Inadequate dike protection is likely to cause undue confidence in them. On the other hand, a proper knowledge of boilover performance will often allow temporary protective measures to be effective in the time between the start of the fire and the boilover.

"The general subject of dike protection involves independent embankments, either temporary or permanent, built to protect property where the hazard of adjacent oil storage prevails. Railroads serving territories where amounts of oil are handled and stored are likely to have numerous cases where sections of track are subject to oil fire hazard. In such cases properly designed embankments may be the means of saving considerable track property and avoiding the consequent serious interruption of traffic.

"The general subject of dike protection is in course of development. After due investigation coupled with study of tank design and fire protective systems this association can prepare a detailed recommended practice. Meanwhile, it is suggested that the committee work be continued along present lines in a manner best suited to secure the desired final results."

K. B. Duncan (G. C. & S. F.) discussed the subject of roofs for fuel oil storage tanks. He reviewed the present practice of roof construction by the oil companies and quoted from a report of the American Petroleum Institute on the subject of oil tank fires in the United States. His conclusions are that with the railroads fire protection probably will be the first consideration and with that the nature of the oil handled, the number of tanks situated together, their proximity to other important facilities belonging to the railway or to outside structures; further consideration should include other facilities at hand for fire protection such as fomite or steam installation, dikes and water facilities. However, the question of fire protection is sure to enter into the problem as the final determining factor.

CONCLUSION

The committee recommended that there be added to conclusion No. 7, relating to dike construction around storage tanks, now appearing in the Manual, the following sentence: "Where a special type of construction is used designed to minimize splashing and wave action the capacity within the dike may be reduced."

Discussion

[The report of the Committee on Shops and Locomotive Terminals was presented by Chairman F. E. Morrow (C. & W. I.), with Vice-President D. J. Brumley (I. C.) presiding. *A motion was made and seconded that the conclusions in Appendix A on storehouses be adopted for inclusion in the Manual.*]

F. R. Judd (I. C.): I believe that a minimum live load as specified at 400 lb. is a little high for the first floor of a building of that kind. It is the recommendation of the Building committee that the loading be placed at 300 lb. Where there is a basement under a building it will add considerably to the expense and will increase the cost of floors, columns, foundations, etc.

A. T. Hawk (C. R. I. & P.): The committee feels willing to make that not less than 300 lb. per sq. ft. for the first floor load.

C. W. Baldridge (A. T. & S. F.): It seems to me that the last paragraph of Section 24 should either be omitted or the wording changed to make it read as an alternate plan.

[*It was moved and seconded that the last paragraph of Section 24 be made to read "For small stores where as elaborate facilities as described above are not necessary, the provisions in the preceding paragraph do not apply. The motion carried.*]

Mr. Baldridge: Article 35 says, "Oxygen and acetylene should be stored in a separate building of light frame work construction, located not less than 50 ft. from main building." I want to ask why the committee recommends frame construction.

Mr. Hawk: Oxygen and acetylene are liable to explosion, and when put in a light frame construction the force of an explosion would not be great. If it were in a concrete or a brick structure the damage to other buildings might be considerable.

[*The motion to adopt Appendix A for inclusion in the Manual was carried. It was also moved that the amendment to the Manual offered by the committee in Appendix B be adopted.*]

W. H. Kirkbride (S. P.): There should be a slight correction under the conclusions in the report on fire wall protection. This does not vitally affect the action on the conclusions as to recommendations in the Manual, but there should be inserted in the third line after the word "can" this phrase, "not at this time." I may add that subsequent to the preparation of these articles in this report, a very extensive oil fire occurred in California due to lightning, that resulted in a reported material damage of $9,000,000. It brings to mind that the important problem is that of protecting oil storage from direct

strokes of lightning and from induced static which may set fire to vapors on the surface of the oil.

This is so vital to the insurance companies that they have practically refused to place insurance except at a prohibitive rate so far as the California fields are concerned.

C. R. Harding (S. P.): I would like to ask if it is not true that the danger of lightning is worse with crude oil than with fuel oil?

Mr. Kirkbride: That is true. Mr. Duncan's report brings that out. I personally believe that with fuel oils as commonly used by the railroads, the danger is slight. With crude oils that are usually stored by the oil companies there is much greater danger, and, of course, that also brings up the subject of refined oils. The least hazardous of all are the fuel oils used by railroad companies.

J. B. Jenkins (B. & O.): I would suggest also that the committee make recommendations in regard to the protection of existing tanks with wooden roofs. A great deal can be accomplished to reduce the risk by placing chicken wire around and over the existing wooden roof. Also, the tank can be absolutely protected against a direct stroke of lightning by the installation of lightning rods of sufficient height so that the distance from the rod to the center of the tank does not exceed four times the height of the rod, and those precautionary measures can be installed at slight expense so as to give much better if not complete protection to existing tanks.

Chairman Morrow: The committee is very glad to receive these suggestions as to further study. The correction suggested by Mr. Kirkbride in the text is also accepted by the committee.

[The motion to adopt the amendment to the Manual was carried and the committee was excused.]

Report of Committee on Records and Accounts

The Committee on Records and Accounts submitted an unusual report in that it broke all precedent and deferred reporting on the subjects which were regularly assigned for its consideration and study during the year. Instead, it asked the association to give its attention to the question of whether the present method of issuing the Manual and annual supplements thereto should not be changed and also whether a change in the methods of arranging the program and conducting the annual meetings should not be made. In a supplementary report an illustration was given of how the committees reporting on related subjects could be grouped for sectional meetings. J. P. Hande, the new chairman, was a member of the committee two years prior to being made chairman.

J. P. Hande
Chairman

THE committee departed from its usual program and deferred presenting reports on the regularly assigned subjects in order to ask exclusive consideration of what it had to recommend under the assignment: "Outline of Work for the Ensuing Year." It presented as information: (1) A brief statement of the progress it had made on its assignments (Appendix A); and for discussion and approval (2) an outline of work for the ensuing year (Appendix B). The action recommended by the committee was that the conclusions in Appendix B be approved.

Committee: J. H. Hande (B. & O.), chairman; G. R. Walsh (Mo. P.), vice-chairman; E. G. Allen (A. T. & S. F.), F. J. Bishop (Ann Arbor), A. M. Blanchard (Can. Nat.), L. H. Bond (I. C.), Carl Bucholtz (Erie), R. R. L. Bullard (A. C. & Y.), W. H. Burrage (N. Y. C. & St. L.), E. S. Butler (M-K-T), H. C. Crowell (Penna.), E. B. Crane (C. M. & St. P.), C. C. Haire (I. C.), H. E. Hale (Pres. Con. Com.), W. A. Hill (C. B. & Q.), F. W. Hillman (C. & N. W.), F. C. Kane (Penna.), W. J. Kelly (C. R. I. & P.), R E. Kennedy (B. & O.), C. A. Knowles (C. & O.), Henry Lehn (N. Y. C.), J. R. Leighty (Sou.), H. T. Livingston (C. R. I. & P.), E. W. Metcalf (M-T-K), R. E. Patterson (L. V.), H. J. Sargent (Wab.), H. F. Sharpley (C. of Ga.), C. K. Smith (U. P.), James Stephenson (A. C. L.), V. R. Walling (C. & W. I.), Joseph Weidel (A. T. & S. F.), and H. R. Westcott (N. Y. N. H. & H.).

Appendix A—Progress on Assignments

The committee reported that its work during the year had progressed in the normal manner and that it has ample material for some very interesting reports, but that it deliberately chose to shelve all its regular reports this year in order that attention might be concentrated on the matters set out in Appendix B.

Revision of I. C. C. Classification of Accounts

Doubtless all are familiar with the progress made by the Interstate Commerce Commission in revising the accounting classifications. The committee as a whole spent an entire week during May, 1926, in critically examining the commission's "March, 1926, draft" of its proposed Road and Equipment Classification.

Since then committees of the Railway Accounting Officers' Association have been negotiating with the commission's representatives, first offering their conception of what such a revised classification should be, and later offering their suggestions on the commission's proposed draft.

The R. A. O. A. is the organization officially designated to deal with the commission on matters relating to the accounts. It is under no obligation to give formal consideration to the recommendations of any section of the American Railway Association, since that organization has not established an official and recognized basis of co-operation. In the absence of such established co-operative relations, it is futile for this committee to continue simply an academic discussion of the classifications.

Appendix B—Outline of Work for Ensuing Year

The committee this year found itself faced with conditions that made it seem advisable to pause in the consideration of its regular assignments, and give some thought to whether or not committee work is being conducted in an up to date and efficient manner.

The committee was asked to rearrange the material in its section of the 1921 Manual, and the supplements thereto, preparatory to the issuance of a new Manual. This reopened the question of whether the system now in effect of publishing that material in substantially its present condition is a satisfactory procedure. We have concluded that it is not.

We are agreed that it was the proper procedure to so compile the data gathered during the past 25 years. However, we have now reached the stage and have enough material at hand to warrant our arranging it with relation to the needs of each branch of a typical engineering organization, and with due consideration and cross reference to its relation to the work of other committees. Consideration should also be given to issuance of the Manual in an annual edition or some other method of keeping it up to date.

This brings us to the question of whether in the future our committee shall consider and report on assignments which are selected more or less casually, or whether it should undertake to chart such a typical organization and lay out a program of subjects for future consideration aimed at providing all of the records and accounting systems required by such a typical organization. The planning of our future course of work and the building of a satisfactory section of our forthcoming Manual are thus intimately connected.

A casual inspection of our section of the Manual confirms the impression that it is not comprehensive. It cannot be made comprehensive unless we adopt a definite schedule of operations. The various sections of our engineering organizations—construction, maintenance, valuation and accounting—have certain definite needs in the way of records, forms, and methods of procedure, which we should undertake to supply in a comprehensive fashion. Developments in recent years of federal accounting regulation and valuation requirements make this necessary to an extent not contemplated by those laying out our procedure 25 years ago.

Back of our idea bringing this matter before the association is one outstanding fact—the task of making the consideration of "Records and Accounts" interesting to practical railroad men is a very difficult one. To those who are dealing every day with the intensely practical angles of railroad engineering administration, the development in detail of forms and records and the outlining of accounting and reporting procedures, is not an attractive subject.

We are convinced that it can be made interesting and attractive. To be that it must deal with the entire subject in so comprehensive a fashion that the most practical of our colleagues cannot take exception to our method of treating the subject.

Our committee considers it of first importance at this time that a new spirit be injected into our work, not only as concerns the attitude of our own committee members to the work at hand, but in the attitude of the association toward the committee's work. To that end it has two definite conclusions and recommendations to make.

In view of the importance of getting real consideration of these recommendations, the committee decided to take the radical step of reserving its reports on its regular assignments this year, and ask for consideration of these two recommendations.

In view of their vital importance to the association, and since if introduced verbally as new business there was no way of getting them before the association in writing prior to the convention the arguments in their support, the committee offered its section of the bulletin as the medium for presenting these subjects.

The committee suggested first that the modernizing of the Manual requires more than the mere republishing of the matter embodied in the present Manual and supplements thereto. It believes that the task of editing the matter for the new Manual is a larger one than should be assigned to the part time efforts of the committees. It recommended that the work of evolving a new and comprehensive Manual be undertaken by a staff of paid full time experts at headquarters.

The second recommendation had to do with the manner in which the convention deals with the reports of the committees. As far as work *within* the Committee on Records and Accounts is concerned, if it has outlined a typical railway engineering organization and can see that its work is aimed at supplying the practical needs of each branch of that organization insofar as records and accounts are concerned, there is no question that this committee's work will be on a practical basis, and it will know where it is headed. With that knowledge will come a new interest and sense of obligation to fill that need.

Committees are handicapped, however, by the casual and indifferent manner in which reports are received. There is no apparent interest, no discussion, and no controversy. Certainly no group of men, such as make up our committees, is infallible. That committee reports are accepted by the convention without comment signifies an utter lack of something.

We are not enunciating anything new. The situation has been clear for some time. It was presented forcefully in an editorial appearing in the *Railway Age* of October 9, 1926, entitled "How Can the A. R. E. A. be Made More Valuable?" which the committee quoted in full.

On August 1, 1925, President Fairbairn sent a questionnaire to chairmen of committees, asking for opinions regarding ten suggested methods of increasing discussion and interest in reports at the convention. These warrant your consideration, and are next quoted:

"(1) To arrange for discussion by former members of a particular committee; to organize beforehand an official opposition.

"(2) To designate certain floor leaders, whose function would be to point out controversial features in reports.

"(3) To hold sectional meetings, and to bring the net results before the general meeting for approval.

"(4) To discuss and accept reports at one meeting and to hold in abeyance final approval until a subsequent meeting.

"(5) To extend the time of the convention for an additional day.

"(6) To limit the presentation of reports to one and not to exceed three subjects.

"(7) To urge members to prepare discussions, either verbal or written.

"(8) That chairmen and vice-chairmen, in presenting reports, omit making extended quotations, and to conserve time by making a brief introductory statement, outlining the points on which discussion is desired.

"(9) To encourage minority reports.

"(10) That committees study a subject at least two years before making a report thereon, progress reports to be made annually, if considered desirable and informative."

The committee recommended the adoption of Method 3: "To hold sectional meetings, and to bring the net results before the general meeting for approval" as the

best method of encouraging discussion and interest in reports at the general convention.

It is possible that we cannot all be agreed that the holding of sectional meetings is the best solution. Many are convinced that such a change would introduce conditions a great deal more objectionable than those it was intended to correct. A review of the various factors involved should dispel that idea.

The *Railway Age* editorial previously quoted was eminently correct in saying that the lack of discussion and acceptance of committee reports without remark is due to the growth of the organization and the crowded program of the convention.

The pressure of limited time discourages discussion, and the very size of the audience is intimidating to many who have excellent ideas but hesitate to speak up in so large a gathering. Both the committees presenting reports and those on the floor interested in the subject being presented are always conscious of the presence of those specializing in other branches of work who are most patently bored by the proceedings and are simply waiting for the presentation of their pet subject.

Knowing as we do the manner of development of committee reports, a casual acceptance of them by the convention cannot help but lessen our appreciation of such reports as being representative of the ideas of the entire organization. If a possible 25 per cent of the convention is directly interested in any subject but hesitates to speak up, the work of a small committee and oftentimes of a single sub-committee chairman goes into the record with the full weight of the association behind it. Such a condition is not healthy, and has a reaction on the frame of mind of the committees themselves.

The committee advanced the proposition that the holding of sectional meetings is a solution of every phase of this problem. The pressure of time limit will be relieved. Each committee can have several hours instead of a fraction of an hour. The assembling in a separate meeting of that portion of our membership really interested in a subject will give a tremendous boost to interest in producing reports of the highest standard. The atmosphere in a smaller meeting room will be a great deal more congenial, and the tongues of our hesitating members should loosen up materially.

Other organizations, such as the American Society of Civil Engineers and the American Society for Testing Materials have found the cure for conditions arising from their growth in numbers by dividing up into technical divisions. The objection may be raised that the holding of several sectional meetings simultaneously may cause this or that member to miss participating in the discussion of a subject in which he is interested due to two or more of such subjects being on the program at the same time. It is believed that in actual practice this objection can be discounted. Such conflict can be overcome by an appropriate grouping of the committees into sections in accordance with their similarity of interest to different groups.

Conclusions

1. That the editing of our Manual and its annual revisions be performed by a staff of paid experts.

2. That the revival of interest, both in committee and at the conventions is vitally essential, and to that end the changing of our convention procedure to that of holding sectional meetings and bringing the net results before the general meeting for approval is the best means of accomplishing such revival.

Supplemental Report

In the original report the committee cited reasons why the Manual should be modernized, and recommended that the conventions be conducted on the sectional plan to overcome the defects inherent in the present system.

The printing of this report in an early bulletin gave an opportunity to consider how the sectional meeting plan would work. To afford a practical illustration of what the committee had in mind, there is given a chart showing how such sectional meetings could be held:

Day and Period		Committee Reports Presented		
		Room A "Track" Subjects	Room B "Structures" Subjects	Room C "Economics and General" Subjects
		General Opening Session		
Tuesday	1st Period	1. Roadway	6. Buildings	12. Rules and Organization
	2nd Period	2. Ballast	7. Wooden Bridges and Trestles	11. Records and Accounts
	3rd Period	5. Track	8. Masonry	14. Yards and Terminals
Wednesday	1st Period	10. Signals and Interlocking	15. Iron and Steel Stresses	16. Economics of Railway Location
	2nd Period	14. Rail	13. Water Service	21. Economics of Railway Operation
	3rd Period	Special—Stresses in Railroad Track	18. Electricity	22. Economics of Railway Labor
Thursday	1st Period	3. Ties	23. Shops and Locomotive Terminals	20. Uniform General Contract Forms
	2nd Period	17. Wood Preservation	9. Grade Crossing Design, etc.	24. Coop. rel. with Univ.
	3rd Period		Special—Clearances	Special—Standardization
		General Closing and Business Session		

Suggested Schedule of Convention Procedure

A general opening session could be held, after which the convention would adjourn to three separate meeting rooms. In each of these rooms these committee reports that are classifiable as of similar interest could be presented in turn. Each day would be divided into three or more scheduled periods of possibly variable lengths, depending upon each year's output of reports. By discussing successively in room A the committee reports dealing with track features, in room B those with structures elements, and in room C the economic and general interest items, those interested in any one of these groups would give to the discussion of the reports therein the degree of participation that would make the meetings very interesting, and the final action on the reports authoritative. That is what is now lacking. At a general closing and business session, action taken on the reports in the sectional meetings can be confirmed by a blanket resolution without further discussion.

Discussion

Chairman J. H. Hande: We have two things to talk about, the Manual and convention procedure. The thing that impelled us to take up these subjects in this way was the fact that we were asked to prepare subject matter for the new Manual. The course of least resistance for us was to take our material and get it in shape in the easiest way possible. The alternative was to question whether the material we had was adequate or not and to go a step further and find out whether the entire Manual was adequate.

It seems to us that the Manual and our printed matter is the only evidence that we have to offer as to the progress of the Association. If our Manuals are defective it must arise from the convention procedure. If the convention procedure is unsatisfactory it must have its effect on the Manual. That there has been something wrong has been generally acknowledged for several years. We feel that we are not getting an expression of opinion from our membership. The question is how to draw out the discussion or the opinion of the qualified members.

Our plan, briefly, is to divide the meeting into three separate rooms and to segregate in each room the allied

subjects, one, track subjects; second, structures subjects; and third, what might be called economics and general subjects. Each committee can have several hours instead of a fraction of an hour. The atmosphere in a smaller meeting room will be more congenial and the tongues of the hesitating members should loosen up materially.

It should be understood that our effort today is to get a solution of this problem. The solution offered may not be the one that appeals to you the most, but I feel that it would not be right if the Association left this room today without settling a problem that has been before us. *I move that it be the sense of this meeting that the sectional plan, either as illustrated or as modified at the discretion of the Board of Direction, is the proper corrective for the conditions that now exist.*

L. A. Downs: I rise to a point of order. We are now receiving the report of the committee on Records and Accounts. I have been a member of this association for 27 years and have attended about two-thirds of the meetings during that time. I have read or looked over all the reports that have ever been made by committees and I think this as near to being nothing as any report I have ever seen.

They have been assigned seven subjects and they have not touched on one of them. They used a page and a half giving reasons why they didn't make any report and then finally come in with an Appendix A, Appendix B and some conclusions that have no bearing whatever on the committee work.

This is something that should be taken care of by the Board of Direction. The fact that this association has progressed speaks for the procedure of the Association. This is one organization that has never had a slump, beginning with a small body of men 27 years ago. Attendance has been larger every year and for a committee to go outside of its own work and make a report of this kind is something that I don't quite understand.

There are some things in this that are really amusing. Appendix B says, "the committee has found itself faced with conditions that made it seem advisable to pause in the consideration of its regular assignments, and give some thought to whether or not committee work is being conducted in an up-to-date and efficient manner."

In the next paragraph the committee says, "this reopens the question of whether the system now in effect of publishing material in the Manual in substantially its present condition is a satisfactory procedure. We have concluded that it is not."

The balance of the report takes as its text an editorial of the *Railway Age* of last year, based on changing our entire proceeding which is a question to be determined by our Board, and that is why I am rising to this point of order.

In sitting in conventions many times and hearing a good report being presented by a good committee, I have often wondered what the president was going to say. He usually said that the committee is dismissed with the thanks of the Association. I believe it would be proper for the President to say that this committee is dismissed with the spanks of the Association. (Applause).

J. L. Campbell: I concur in what Mr. Downs has said. During the life of this association, now 27 years old, we have had a definite organization and a definite plan of work which has produced results. Judged by results as they stand today there is nothing to indicate that there is anything radically wrong with the system under which we have been working, and assuredly we should proceed very slowly indeed in considering a change in our organization or method of work.

As to the action of this committee I think that the precedent would be a bad one. If our standing committees are going to depart from the work assigned, it will disorganize our work, and will be disastrous to the Association. This is distinctively a matter which should receive careful consideration by the Board of Direction. There are ways of bringing that to the attention of the Association. If this had come to the Association in the form of a suggestion after the regular report had been made, well and good. The Association and the Board of Direction are always open to suggestions. It does seem to me that if our standing committees are going to take the liberties with their assignment of work to the extent of discarding them entirely, we will introduce a state of anarchy here and the splendid progress that we have been making will be checked. (Applause).

Hunter McDonald (N. C. & St. L): I rise to a point of order. I fear Mr. Downs did not quite make his point of order clear. I want to point out that a point of order is not debatable. The debate on this question has already proceeded further, in my judgment, than should have been permitted. The question raised by this committee is a function of management which as defined by the constitution is placed in the hands of the Board of Direction.

The rules which the Board of Direction has adopted for the preparation and consideration of the committee reports have been violated. I call for a point of order.

[The President ruled that the subject was out of order.] (Applause).

Chairman Hande: I can take no exception. The committee considered this point before it prepared this report. We felt that since the precedent of the Association two years ago—

Mr. McDonald (Interrupting): I rise again to a point of order and wish to state the Chair should rule on it. I will appeal to the decision of the Chair on the vote of the Board.

Chairman Hande: The second matter in our report is similar to the first and must rise or fall with the first; that dealing with the Manual.

Mr. Downs: I rise to a point of order. We are not discussing the report on Records and Accounts. Will the Chair please rule on the committee and dismiss the committee if it has no report to make? (Applause).

President Felt: The Chair rules that unless the committee has a report to make on the subjects assigned to it, it will be dismissed. (Applause).

Chairman Hande: The chairman of this committee has considered that the subject assigned to as work for the ensuing year covered this. That is why we have reported it "Outline of work for ensuing year." If this is interpreted by the Chair as not proper there is nothing in the criticism to warrant the discussion and I have nothing further to say. Aren't the steam rollers working perfectly?

J. M. R. Fairbairn (C. P.): On the point that the chairman of the committee has just raised, I understood him to say in his opening remarks that he trusted a decision on his conclusion would be reached in this meeting, at this time. If that is the case I don't quite understand his suggestion that this was brought up for the outline of work of the committee for the following year.

Mr. Downs (I. C.): Next committee! Next committee!

[The committee was dismissed without comment from the chair.]

Report of Special Committee on Standardization

The Special Committee on Standardization is made up of the chairmen of the standing committees. It did not report last year, and this year it also departed from the usual practice of reporting on assignments, and gave a review of the work it has done since it was organized, detailing the assignments it has been given. Several years ago relations were established with the American Engineering Standards Committee and the report explained what this committee is, what it does, what it has accomplished, and how it functions. It also discussed what should be the relationship between the A. R. E. A. and the A. E. S. C. and outlined a policy of procedure concerning recommended practice for inclusion in the Manual. W. C. Cushing, the new chairman, is a charter member of the Association, has been chairman of the Rail Committee, and was president in 1912.

W. C. Cushing
Chairman

IN ITS report the Special Committee on Standardization reviewed the activities of the committee since its organization in 1919 and quoted the instructions given it by the Committee on Outline of Work for its first report, which were as follows:

1. Request appropriate committees to each select one or more articles for standardization, with instructions to harmonize the views of the railroads and manufacturers as much as practicable, and to prepare plans and specifications of as few sizes as will meet the needs of the railroads.

2. Secure the general use by the railroads of the standards and specifications, bringing about a realization of all possible economies of cost and time.

Subsequently the Board of Direction instructed the Committee to confine its efforts to the general adoption by railroads of the standards and recommendations shown in the manual, and to formulate suggestions for bringing about a realization of all possible economies of cost and time.

For the work to be reported on in 1921 the instructions to the committee were as follows:

1. Review at once, plans and specifications heretofore adopted and suggest to the Committee on Outline of Work a list of recommendations which interest more than one committee or of which further study ought to be made in the interest of improving such plans and specifications with a view of having the Committee on Outline of Work issue specific instructions to the several committees to undertake certain of this work during the coming year. The purpose of this being the development of minimum specifications for as many items of standard railway materials as possible, not only in the interest of economy and better materials, but to insure the fullest measure of competition.

2. Endeavor to secure the more general use by railways of the specifications, standards and recommendations of the Association, as a means of saving time and money.

3. Submit as suggested work for each committee for the 1921 outline of work definite recommendations for minimum specifications for specified items of standard railway materials.

No subjects were assigned to the committee in the bulletin containing the outline of work and personnel of committees for the work which would be reported upon at the 1922 convention, but the following instructions were approved by the Committee on Outline of Work of the Board of Direction:

Select articles, the standardization of which will benefit the consumers and the producers. Request the Committee on Outline of Work to have plans and specifications, if required, prepared by the appropriate standing committee and calling for as few sizes and types as will meet the needs of the consumers. Handle until a satisfactory design is obtained and promote its adoption by the roads and producers.

Later, the committee recommended that certain subjects be submitted to the American Engineering Standards Committee as a basis for standardization. One of these specifications, for railroad cross ties and switch ties, has been adopted during the present year as the American standard by the American Engineering Standards Committee under the sponsorship of the American Railway Engineering Association and the forest service of the United States. Work is now under way under the auspices of the American Engineering Standards Committee on two of the other projects relating to cast iron pipes, hydrants and valves, to adhesive tape and rubber insulating tape, and insulated wires and cables (other than telephone and telegraph). Nothing appears to have been done concerning tamping bars, tamping picks, ballast forks and railway lamps, which were other projects recommended.

A close perusal of the open discussion on the floor of the conventions as shown in the reports of 1922, 1923 and 1924 made it evident that more knowledge of the American Engineering Standards Committee and the relation of the A. R. E. A. with it was desirable and even urgent.

The committee therefore undertook this self-imposed task, and offered the following:

THE AMERICAN ENGINEERING STANDARDS COMMITTEE

1. It is a movement rather than merely a formal federation, a co-operative movement in which industrial, technical and governmental bodies are broadening and unifying their standardization work into a consistent system of national industrial standards.

2. It is the agency or national clearing house through which engineering and industrial standardization is passing from the second to the third stage, viz., from standardization by associations, societies and governmental agencies to standardization on a national scale.

3. The constitutional statement of objects is as follows:

"Section C2.—To provide means by which various organizations engaged in formulating engineering standards may cooperate with one another, thus avoiding the duplication of standardization work and promulgation of conflicting standards.

"Section C3.—To collect and make accessible to organizations and individuals information concerning standardization work in the United States and foreign countries.

"Section C4.—To receive and pass upon recommendations for standards submitted to it by other organizations in accordance with its rules of procedure, with the object of establishing American Engineering Standards; but not to formulate standards.

"Section C5.—To promote in foreign countries the knowledge of recognized American engineering standards.

"Section C6.—To act as the authoritative channel of cooperation in international engineering standardization."

4. The committee had its beginning on January 17, 1917, at a meeting of a special committee appointed jointly by the four national engineering societies and the American Society for Testing Materials for the formulation of some method of cooperation to prevent duplication in standardization work and the promulgation of conflicting standards.

5. Since then additions have been made so that there are now 24 member bodies, each having from one to three representatives whose term of service is three years.

6. There is an advisory committee of industrial representatives, designated at a conference of industrial executives March 30, 1925, as follows:

J. A. Farrel, President, U. S. Steel Corporation.

Geo. B. Cortelyou, President, Consolidated Gas Company of New York.

J. W. Lieb, Vice-President, New York Edison Company.

L. F. Loree, President, The Delaware & Hudson Company.

Gerard Swope, President, General Electric Company.

Its Official Organization

7. It has an elected chairman and vice-chairman and executive committee from the member-bodies, who engaged a secretary not a member of the committee.

8. The representatives of the member-bodies are known as the main committee.

9. A cooperating-body is a national trade association, a technical society, a government depart or bureau, without financial obligation, whether represented on the main committee or not, interested in standards, cooperating in the work of the committee and abiding by its rules.

10. A sustaining member is an organization, firm or individual interested in the work of the committee and subscribing directly to its support. He is entitled to the information service on current developments in industrial standardization work, both in this country and abroad, and is entitled to make use of it on any special questions which might arise in connection with its own work. The file now includes complete sets of standards approved by all the foreign international standardizing bodies, and a great majority of the standards issued by the important organizations in this country. About 7,000 standards are now on hand.

What It Costs

11. The expenditures of the committee are now at the rate of approximately $55,000 per annum. Of this only $20,000 is covered by dues of membership bodies, which are $500 annually for each representative on the committee *with the exception of the government departments, which have not yet been authorized by congress to contribute directly towards the expenses of the committee.* The remainder is made up by voluntary subscriptions of sustaining members and others.

12. The committee needs additional funds to the extent of not less than $75,000 per annum.

Methods

13. The method of work is simply a systematic plan of cooperation by which all organizations interested in any particular standardization project participate:

(1) In deciding whether the work shall be undertaken at all.
(2) In formulating the standards.
(3) In its ultimate approval as an "American Standard" or a "Tentative American Standard."

14. It is not an initiating body, and work on a project is undertaken only on the formal request from a responsible body, and then only after the committee has assured itself that it is the desire of industry that the work shall go forward.

15. A special committee advises the chairman on the items for the agenda of a conference at which it is asked to decide:

(1) Whether the work shall be undertaken.
(2) If so, what its scope shall be.
(3) How the work shall be organized.
(4) How it is to be related to any other work having an important bearing on it.

16. The projects are submitted to the main committee in either of two ways:

(1) Submission of standards already developed by an organization and according to procedure substantially in conformity with the rules of the committee.

(2) Suggestion by an industrial, technical or governmental body that a subject or article should be studied for development as a standard.

The remainder of the report went into great detail as to the procedure for the development of a standard; reviewed the accomplishments of the American Engineering Standards Committee up to January 31, 1926; and discussed at considerable length the question of what should be the relationship between the American Railway Engineering Association and the American Engineering Standards Committee. The committee also outlined a policy of procedure concerning recommended practices which it suggested the American Railway Engineering Association should follow and recommended that this be incorporated in the Manual as follows:

Policy of Procedure Concerning "Recommended Practices"

(A) The motive force of this Association is the standing committees and its organized effort by means of disseminated rather than by central concentration.

(B) A standing committee shall be the continuing sponsor of its own adopted "recommended practices," embracing the following duties:

(1) An annual review of each Manual-incorporated "practice" with the recommendation for revision when found desirable.

(2) A statistical survey periodically to ascertain the extent of use by the Association members of the "practice" under study.

(3) Selection of an "Association-adopted recommended practice" as worthy to be considered of "mutual interest" and importance to special industry and technical associations, or of national scope, coupled with an outline of its scope, a complete history of its development and a full statement of the extent of its use, for presentation to the Board of Direction with recommendation that it be submitted for cooperation with the bodies in which right of action has been vested. In the case of industrial—and Association—mutual interest the active body will be a cooperative committee or technical association, and in the case of national scope, the American Engineering Standards Committee.

(C) The Board of Direction, after favorable action upon the recommendation of a sponsor committee, shall proceed as follows:

(1) In the case of industrial—and Association—mutual interest, authorize the secretary to present the proposal to the interested body.

(2) In the case of national scope, authorize the secretary to request the approval and further action of the American Railway Association.

(D) The Special Committee on Standardization shall keep informed of the rules of procedure and general fields of activity of the associations and committees which may be considered to have interests in common with this Association, and shall be kept informed of the special co-ordinating recommendations of standing committees, in order to act as an advisor to the Board of Direction.

(E) Attention has been called to the fact that sometimes several members from the Engineer division have been designated to serve on the same sectional committee, American Engineering Standards Committee, without having any point of contact for concerted action. It is desirable, therefore, when these committee members are named by the secretary of the American Railway Association, in the case of several being appointed, for the Secretary to name one of them to act in bringing them all together as may be considered desirable, in order to keep each other posted on the things which are being done and to enable them to decide on their mode of procedure.

44. These recommendations provide for a continuing organization for activity on the part of the Special Committee on Standardization, and as no additional instructions will be necessary, no suggestions for future commands are made.

Appendix A contained a list of the projects upon which the American Railway Association is cooperating; Appendix B gave a list of the engineering and industrial standards officially approved by the American Engineering Standards Committee; while Appendix C gave a special index of United States

government master specifications and a statement of how these specifications may be obtained.

Committee: W. C. Cushing (Penna.), chairman; J. R. W. Ambrose (Toronto Term.), vice-chairman; J. C. Wrenshall (Reading), J. G. Bloom (C. R. I. & P.), W. J. Burton (M. P.), Earl Stimson (B. & O.), J. V. Neubert (N. Y. C.), W. T. Dorrance (N. Y. N. H. & H.), W. E. Hawley (D. M. & N.), C. C. Westfall (I. C.), T. E. Rust (W. C. F. & N.), F. B. Wiegand (N. Y. C.), J. H. Hande (B. & O.), W. C. Barrett (L. V.), C. R. Knowles (I. C.), B. R. Leffler (N. Y. C.), F. R. Layng (B. & L. E.), F. C. Shepherd (B. & M.), E. B. Katte (N. Y. C.), J. C. Irwin (B. & A.), J. M. Farrin (I. C.), C. C. Cook (B. & O.), F. E. Morrow (C. & W. I.), Robert H. Ford (C. R. I. & P.), F. L. C. Bond (C. N. R.), J. E. Saunders (D. L. & W.).

Discussion

The report of the committee was presented by W. C. Cushing (Penna.), chairman, who read the committee's recommendations on Policy of Procedure Concerning Recommended Practices, and *moved that the subject read be presented to the Board of Direction with the recommendation that it be made the policy of procedure concerning recommended practice and the work of the committee, and that it be made a part of the Manual, if the Board accepts the recommendation.* [*The motion was carried.*]

Chairman Cushing: During the latter part of 1926 an important stride forward took place in the interest of industrial standardization, resulting in the appointment of a committee on Standardization Survey composed of the following: Herbert Hoover, Chairman; George K. Burgess, George B. Cortelyou, E. DeGolyer, James A. Farrell, E. M. Herr, J. H. Gibboney, John H. Hunt, Dexter S. Kimball, John W. Lieb, Charles M. Schwab, Hugh Shirkie, C. E. Skinner, John F. Stevens, Gerard Swope, L. W. Wallace, W. Chattin Wetherill, Secretary.

Every one of these names is a name of importance in the United States. Besides the names in government and industry, the committee also includes the presidents of the four national engineering societies, the American Society for Testing Materials, and the chairman of the American Engineering Standards Committee.

These men were brought together through the instrumentality of the secretary of the American Society of Mechanical Engineers who has been an outstanding figure in connection with standardization work and the statement was made to Mr. Hoover that this kind of movement required an expenditure in the neighborhood of a half million dollars a year. The present American Engineering Standards committee is trying to get along on $50,000 to $60,000 a year and finds itself much hampered in its work.

That statement indicates how important these industrial managers have considered the work to be. This committee known as the Committee on Standardization Survey is for the purpose of surveying the field, finding out how many different organizations in the country are engaged in standardization work, and then to recommend such an organization as will make this work truly national and finance it so that it can be carried on without a constant struggle. [*There being no further discussion the committee was excused.*]

Report of the Committee on Electricity*

The Committee on Electricity also constitutes the newly formed electrical section of the American Railway Association which has been organized as a part of Division IV—Engineering, and the chairman of this committee is chairman of the section. Fourteen subjects were considered during the year and final reports were made on specifications for rubber insulating tape and the schedule of incandescent lamp standards. The report also contained descriptions of the water power developments on Passamoquoddy bay, at Conowingo, Md., and at Lake Wallenpaupack; progress was reported on the remaining subjects except that of revising of the National Electrical Safety Code which was submitted as information. E. B. Katte has been chairman of this committee since 1918.

E. B. Katte
Chairman

THE COMMITTEE on Electricity presented reports on 14 different assignments as follows: Progress reports were submitted on inductive co-ordination (Appendix B); electrolysis (Appendix D); co-operation with United States bureau of standards in the revision of the National Electrical Safety Code (Appendix E); overhead transmission lines and catenary construction (Appendix F); collaboration with the Committee on Economics of Railway Location (Appendix G); standardization of insulators (Appendix I); clearances for third rail and overhead working conductors (Appendix J); protection of oil sidings from danger due to stray current (Appendix K); specifications for track and third rail bonds (Appendix L); and the design of indoor and outdoor substations (Appendix N); while the report on water power (Appendix C) was submitted as information. In Appendix H the committee presented a specification for rubber insulating tape and in Appendix M a revised schedule of incandescent lamp standards for inclusion in the Manual. It recommended that the remaining subjects be continued.

Committee: E. B. Katte (N. Y. C.), chairman; W. M. Vandersluis (I. C.), vice-chairman; F. Auryansen (L. I.), B. F. Bardo (N. Y. N. H. & H.), H. M. Bassett (N Y. C.), R. Beeuwkes (C. M. & St. P.), D. J. Brumley (I. C.), J. C. Davidson (Am. Loc. Co.), J. H. Davis (B. & O.), J. V. B. Duer (Penna.), G. Eisenhauer (Erie), F. D. Hall (B. & M.), W. L. Morse (N. Y. C.), R. J. Needham (C. N.), A. E.

*This is also the report of the newly formed Electrical Section, American Railway Association.

Owen (C. of N. J.), M. Schreiber (Pub. Ser. Ry. of N. J.), H. M. Warren (D. L. & W.), L. S. Wells (L. I.), C. G. Winslow (M. C.), R. P. Winton (N. & W), S. Withington (N. Y. N. H. & H.), A. H. Woollen (I. C.), and G. I. Wright (I. C.).

Appendix C—Water Power

In this appendix the committee submitted information which was largely supplemental to its reports in preceding years on this subject. The points which were covered included: (1) The tidal water project on Passamaquoddy bay on the Bay of Fundy; (2) the Conowingo water power development on the Susquehanna river; (3) the Wallenpaupack hydro-electric development at Wilsonville, Pa.; (4) the international development of power on the St. Lawrence river.

The tidal water power project on Passamaquoddy bay in which it is proposed to harness the power of the tidal waters for the utilization of man was reviewed in considerable detail and a detailed description of the means by which it is proposed to generate the power by keeping the two pools in the project at separate elevations was given. This project is only in the initial stages, as to date no construction work has been done.

The Susquehanna Power Co. is developing water power on the Susquehanna river by means of a dam situated near the village of Cnowingo, Md. The drainage area above the dam is approximately 27,015 sq. mi. and the height of the water impounded is controlled by an existing power plant about 13 miles further up the river. The flow is very irregular, ranging from 2,000 cu. ft. per second to a maximum of 750,000 cu. ft. per second. The dam is 2,250 ft. long and will supply an average working head of 86 ft. When the entire project has been completed there will be 11 complete units, each capable of developing 36,667 Kv.a. The estimated cost of the project is $52,200,000, including the transmission lines to Philadelphia, about 70 miles.

Appendix E—Cooperation with the United States Bureau of Standards

The committee conferred with the United States bureau of standards in the revision of the National Electrical Safety Code under the procedure of the American Engineering Standards Committee. Progress was made in relation to various parts of the code, including rules for the installation and maintenance of electrical supply stations, grounding rules, and the rules for the installation and maintenance of overhead and underground electrical supply and signal lines. The first two were found acceptable and the committee reported they can be recommended for acceptance by the American Railway Association when the entire code has been finally revised. On the other hand, the rules for the installation and maintenance of overhead and underground electrical supply and signal lines were not satisfactory, particularly in respect to clearances and strength of structures where long spans and high voltages were involved. The representative of the American Railway Association submitted to the chairman of the sectional committee of the American Engineering Standards Committee which has this matter under consideration, a minority report in which he discussed in detail the items which are unsatisfactory from a railroad viewpoint. As a result, the sponsor for the code requested no action be taken and it is understood this part of the code will be referred back to the sectional committee.

Part 3—Rules for the installation and maintenance of electrical utilization equipment has also been found unsatisfactory from a railroad viewpoint and a minority report was also filed with the sectional committee. The committee recommended the following:

Conclusions

That the work be continued in cooperation with the U. S. bureau of standards for the revision of the National Electrical Safety Code under the procedure of the American Engineering Standards Committee with the understanding that in so far as Part 2 of the code is concerned, the railroad representatives will cooperate in the preparation of specifications in accordance with the final revision of this part of the code provided the final revision incorporates such changes as may be necessary to meet the criticisms expressed in the minority report of the railroad representatives, dated June 18, 1926.

Appendix F—Overhead Transmission Line and Catenary Construction

The assignment of duties under this head included: (1) Revise and keep up to date the transmission line specifications previously adopted; (2) follow up transmission line construction; (3) inaugurate a study of design and construction for catenary supported working conductors, submitting this year a preliminary report. The action taken by the committee was (1) to invite members of the section to submit suggestions for the revision of the transmission line specifications as the result of experience with them. None were submitted, nor did the committee find it advisable to initiate any revisions in order to keep the specifications up to date. (2) No action was taken by the committee in connection with the second assignment, inasmuch as its subject matter seemed to be covered by assignment number one. (3) The subject matter of assignment No. 3 was segregated into three parts: (1) Clearances; (2) catenary and transmission construction; and (3) structures; and the necessary subcommittees have been appointed to consider them.

The remainder of the report contained in this appendix was a discussion of the work which it is proposed to do under the assignments.

Appendix H—Specifications for Rubber Insulating Tapes

The committee collaborated with representatives of the Telegraph and Telephone section, the Signal section and the Mechanical division in the preparation of these specifications. They are acceptable to all but the Signal section, which prefers to retain the requirements with regard to dry up-river Para rubber, a formula for the rubber compound and the phraseology of their present specifications. The committee recommended that the specifications for rubber insulating tape be adopted for insertion in the Manual, and that the study of friction and rubber tapes be continued.

Appendix L—Specifications for Track and Third Rail Bonds

The report of last year was the first submitted on this subject and the assignment was continued this year with a view to: (1) Developing a standard specification for measurement of bond resistance; (2) securing data on current carrying capacity of bonds; (3) making a study of details of bond design

with a view to developing specifications covering the different classes of bonds; (4) determine the effect of heat of welded bonds on track rails, cooperating with the rail committee; (5) develops a means of attaching bonds to manganese track rails.

A specification for the measurement of stud terminal bond resistance has been developed but it yet remains to develop the necessary data covering welded bonds.

Some preliminary tests have been made on the current-carrying capacity of bonds but the results are not conclusive. The development of the welded type of bond which permits of current densities very much higher than mechanically applied bonds makes it necessary to give this subject further consideration.

A study of the details of bond design with a view to developing specifications has been undertaken and a questionnaire will be issued to the bond manufacturers for their recommendations for the guidance of the sub-committee in its further study of this subject.

The effect of heat of welded bonds on track rails has been the subject of joint meeting with sub-committee No. 6 of the Rail committee. The Committee on Electricity passed the following resolution:

"The Electrical section looks with favor upon the extended use of welded track bonds attached to the side of the head of the rail by electric or gas weld process and asks the advice of the Rail committee if there is any objection on its part to such method of track bonding for traction purposes."

In response to this resolution the chairman of the Rail committee advised that the matter has not yet been acted upon by that committee. This subject will be continued and a complete report will be made as soon as the Rail committee has acted upon the resolution.

Some progress has been made on the means for attaching bonds to manganese rails and the subject will be continued with a view to inclusion in next year's report.

Appendix M—Illumination

The title of this subject was changed from Specifications for Incandescent Lamps to Illumination and its scope extended to include flood lighting for classification yards and for other railway purposes. The committee reviewed and revised the tungsten lamp schedule as it now appears in the Manual with a view to suggesting one schedule of lamps acceptable to the operating, engineering, and mechanical divisions of the American Railway Association. The revised schedule was submitted to the Telegraph and Telephone section, the Signal section, and the Mechanical division for consideration. The committee believed that the revised schedule should be more acceptable than the one now in use and that it will be of more assistance to the purchasing agents of the railroads than the previous standards. The schedule as submitted was recommended for inclusion in the Manual as a substitute for the one now appearing there.

Appendix N—Design of Indoor and Outdoor Substations

The work under this assignment has been divided among three sub-committees as follows:

Subcommittee No. 1 is to determine the conditions affecting the selection of indoor and outdoor types of substations and the applicability of various methods of controlling substation equipment. In the conditions which have a bearing on the selection of the type of substation there are two major conditions to be given consideration: First, the location of the substation with respect to surrounding property; second, the character of apparatus which the substation is to accommodate.

In general, the combination of manual and remote control is the prevailing method of handling both indoor and outdoor substation equipment. In recent years, however, the use of automatic control and semi-automatic control has grown considerably and both systems have lent themselves readily to the application of supervisory control. The present tendency is toward the installation of a system of control which may be operated either automatically, semi-automatically or through the medium of supervisory control from a central point. It was the committee's opinion that while manual and remote control are at present the predominant methods of handling substation equipment, they are gradually giving place to automatic, semi-automatic and supervisory control from a central point.

The assignment to subcommittee No. 2 requires it to study and report on the present development and major considerations in the selection of circuit breakers, air brake switches, transformers, synchronous converters, motor generators, synchronous condensers, mercury arc rectifiers, relays, lighting arresters, meters and meter transformers. In its report the committee discussed in considerable detail the several types of equipment enumerated.

The assignment to subcommittee No. 3 calls for a study on substation design best fitted to obtain the maximum of safety and continuity of service during maintenance, repairs and operation, as well as several miscellaneous subjects including clearances between conductors, adequate installation, emergency grounding practices and the possibilities in unit type of construction as applied to substations. The report contained in this appendix was intended to give a general outline of the subjects under consideration and was submitted as a progress report with the recommendation that an additional item—ventilation of substations—be assigned as a part of the work for next year.

Discussion

[In the absence of Chairman E. B. Katte (N. Y. C.) the report on Electricity was presented as the report of the Electrical Section—A. R. A., by Chairman S. Withington (N. Y., N. H. & H.) following which motions were made and carried without discussion to adopt the sections recommendations in Appendix A on revience, Appendix C on water power, and Appendix D on electrolysis.]

Chairman Withington: Since the report on Appendix E was published there has been a revision which clarifies the atmosphere. I am going to ask the Chairman of the sub-committee to explain the provision that has been made.

W. L. Morse (N. Y. C.): Part two, of the code is one with which we have had particular difficulty in dealing. This deals with the rules for the installation and maintenance of overhead and underground electrical supply and signal lines, and the power lines crossing railroads. Because of the fact that we could not get the requirements as the railroads saw them, it became necessary to file a minority report.

We also disagreed with part three dealing with de-energizing switches but as I understand it, the Bureau of safety has found that our objections were well grounded and has agreed to revise part three.

I move that this report be accepted with the provision that it be continued as further work.

R. H. Ford (C. R. I. & P.): I second that motion. I hope the convention caught the force of it. It means substantially that the Electrical Section is on guard against the Bureau of Standards adopting something that is inconsistent with good practice on the railroad. [*The motion was put to a vote, carried,* following which all other reports and recommendations of the committee were presented in turn and motions to adopt were made and carried without discussion, the committee then being excused.]

Report of the Committee on Track

The Committee on Track reported on five subjects and, as last year, recommended numerous changes and additions to the plans in the Manual. The major work of the committee during the year was the completion of 11 standard plans prepared in conference with the Manganese Track Society. These plans include those on solid manganese steel crossings, steam roads over steam roads, movable point crossings, flange or self-guarded frogs, and solid manganese crossings of steam roads over electric railways. The committee also submitted plans for foundations and for tie spacing and timbering under crossings, and information received in reply to a questionnaire relating to curve elevation. J. V. Neubert has been chairman of the committee for two years and a member for 11 years.

J. V. Neubert
Chairman

THE committee reported on: (1) Revision of the Manual (Appendix A). (1-A) Report on matter now appearing in Manual relating to curve elevation, canvassing various railroads with a view of ascertaining their practices and views, and recommend such changes as are found to be desirable (Appendix B). (2) Detail plans of switches, frogs, crossings and slip switches, including self-guarded frogs (Appendix C). (3) Track construction in paved streets (Appendix D). (4) Specifications and designs for foundations under railroad crossings; also tie spacing or timbering under crossings (Appendix E).

It recommended: (1) That the changes in the Manuel outlined in Appendix A be approved and that revised version be substituted for the present recommendations in the Manual. (2) That the conclusions in Appendices C and D be adopted as recommended practice and published in the Manual as outlined in these reports. (3) That reports and plans as outlined in Appendices B and E be received as information.

Committee: J. V. Neubert (N. Y. C.), chairman; C. R. Harding (S. P.), vice-chairman; J. B. Akers (Sou.), L. B. Allen (C. & O.), Victor Angerer* (Wm. Wharton, Jr., & Co., Inc.), W. G. Arn (I. C.), J. B. Baker (Penna.), C. W. Breed (C. B. & Q.), H. W. Brown (Penna.), H. G. Clark (C. R. I. & P.), J. W. De Moyer (A. C.), J. E. Deckert (Cont. Eng'r.), L. W. Deslauriers (C. P. R.), E. B. Entwisle (J. & S. C.), F. S. Hales (N. Y. C. & St. L.), W. J. Harris (C. B. & Q.), O. F. Harting (T. R. R. A.), T. T. Irving (C. N. R.), H. D. Knecht (M. P.), E. R. Lewis (M. C.), F. H. Masters (E. J. & E.), S. B. McConnell (C. P. R.), C. M. McVay (N. Y. C.), J. C. Mock (M. C.), J. B. Myers (B. & O.), A. J. Neafie (D. L. & W.), G. A. Peabody (Cleveland Frog & Sw. Co.), W. H. Petersen (C. R. I. & P.), O. C. Rehfuss (Can. Steel Foundries), R. B. Robinson† (U. P.), I. H. Schram (Erie), G. J. Slibeck (Pettibone Mulliken Co.), G. M. Strachan (A. T. & S. F.), J. B. Strong (Ramapo Ajax), E. D. Swift (B. Ry. of C.), J. R. Watt (L. & N.).

*Died May 5, 1926.
†Died Feb. 1, 1927.

Appendix A—Revision of Manual

The committee recommended the withdrawal of plan No. 670, standard dimensions for solid manganese steel frogs and plan No. 700, application of A. R. E. A. crossing designs and recommended practices. It also recommended a number of specific additions to sections already in the Manual, the addition of notes to certain standard plans and the withdrawal of Index date March, 1926, for which a revise index was submitted.

Appendix B—Report on Curve Elevation

A questionnaire was sent to 213 railroad officers. Thirty replies or 14.1 per cent of the total were received and are summarized as follows:

1. (Q) Do you use the formula and table for curve elevation shown in the 1921 Manual, page 184?

(A) Sixteen roads use the formula and tables, 12 of them with slight modifications, while three roads use formula and tables as a guide only. One road uses formula but elevates to nearest ½ in., while one road uses formula but elevates to nearest ¼ in. One road uses speeds about five miles per hour higher than in the table, one road uses speed lower than in table while three roads do not use the formula.

2. (Q) If so, how do you determine the speed for which a curve is elevated?

(A) Speed is generally determined by local conditions to insure comfortable riding of fast trains, safe operating conditions for slow freight trains and minimum amount of rail wear. Generally, speed is fixed by experience in conformity with requirements. Three roads elevate generally for specific speeds, two roads for fastest scheduled trains and two roads for average speed.

3. (Q) Do you use the graphs on pages 189, 190 and 191? For what purpose and to what extent?

(A) Fifteen roads do not use the graphs, but one road may adopt use in the near future, while eight roads used the graphs, three as a guide, three as a check in connection with investigations of derailments.

4. (Q) Do you use the graphs on pages 192 and 193? For what purpose and to what extent?

(A) Eighteen roads do not use the graphs, but one road may adopt use in the near future, while eight roads use the graphs, two of them as a guide, two as a check in connection with the investigation of derailments, and one for determining speeds through level turnouts.

5. (Q) If you do not use the graphs, what method, if any, do you use for determining overturning, safe and comfortable speed on curves and speed through level turnouts?

(A) One road uses formula in Manual, while one road uses formula in Vol. 15, Proceedings (p. 570). Two roads have no specific method. One road uses formula: "Elevate curves by the middle ordinate measurement of a chord as long in feet as the speed in miles per hour plus 50 per cent." One road determines safe speed with resultant 3 in. from center line of track. This road uses 15 miles per hour for a No. 11 turnout and 30 miles per hour for a No. 18 turnout. Twelve roads determine the superelevation on curves and the safe speed through turnouts by experience and actual observation of conditions.

6. (Q) Would you recommend the following table for the Manual? (This table is compiled from data contained in the Manual and data in Proceedings, 1914, Volume 15, Page 570.)

a. Up to what degree of curvature do you recommend this table be extended?

(A) Three roads do not recommend, while 15 roads recommend extensions ranging from 6 deg. to 20 deg. One road recommends publication in special bulletin.

7. (Q) If you do not recommend the table, what are your reasons?

(A) Four roads answering give as reasons that factors are indeterminate, and theoretical, and tables in the hands of foremen would cause confusion.

8. (Q) If you do not recommend the table, would you recommend that the elevation table, page 184 of the Manual, be retained in the Manual with the statement that the elevations shown in this table would not be correct for general use without considering certain factors?

(A) Eight roads recommend retaining the old table and supplementing with new table, one by issuing a special bulletin, while one road recommends using only "Equilibrium" and "Comfortable" speeds.

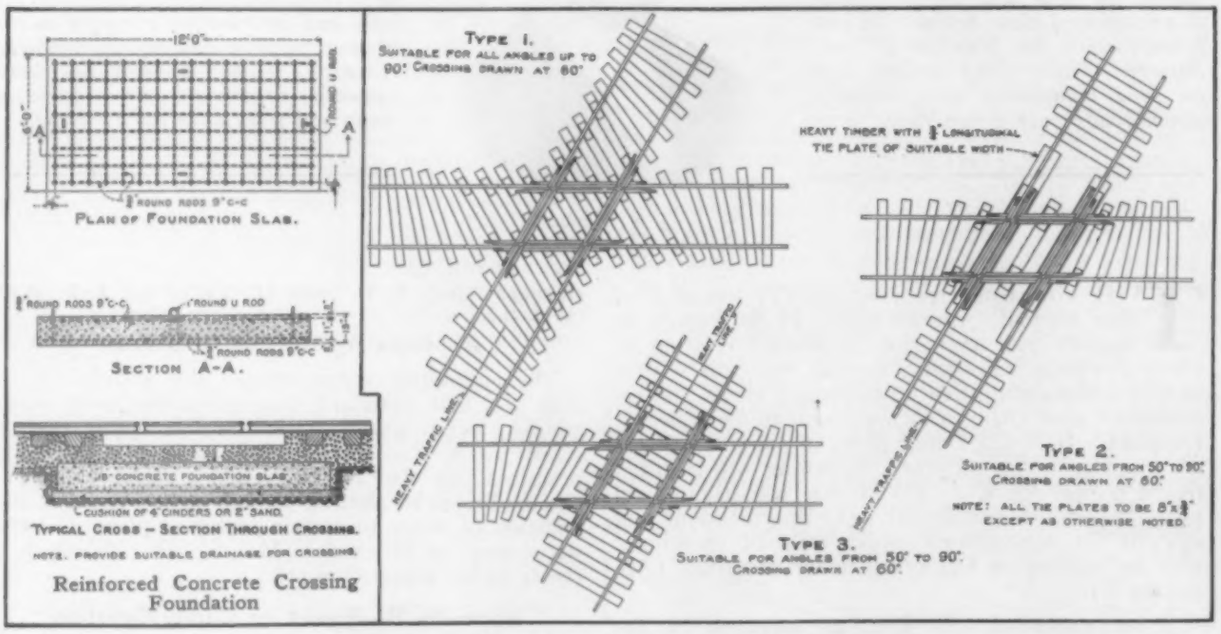
9. (Q) Enumerate some of the factors which you think should be considered.

(A) Factors enumerated by 11 roads are: Relation of curve to grade line; proximity of stations, crossings, junctions, important bridges, etc.; types of locomotives and their action on track; maximum overturning and safe speeds, possibility of overturning inwardly at slow speed; riding comfort; track resistance for freight trains; desirability of maintaining high speed for passenger trains; standards of maintenance; construction of cars and effect of superelevation on their mechanical fitness for high speed on sharp curves; preponderance of traffic; rail wear; and wheel flange wear.

10. (Q) Would you recommend a more elaborate explanation of the application of the table?

(A) Thirteen roads do not recommend more elaborate explanation, six recommend additional explanation, while one would not retain the equilibrium table unless it is followed by a clear statement that it is for equilibrium only, and does not show elevations in the tracks except purely as a basis for computation.

11. (Q) Do you recommend a revision of the Manual on this subject?


12'0"
PLAN OF FOUNDATION SLAB.
SECTION A-A.
TYPICAL CROSS – SECTION THROUGH CROSSING.
NOTE: PROVIDE SUITABLE DRAINAGE FOR CROSSING.
Reinforced Concrete Crossing Foundation
TYPE 1.
SUITABLE FOR ALL ANGLES UP TO 90° CROSSING DRAWN AT 60°
HEAVY TIMBER WITH ¾" LONGITUDINAL TIE PLATE OF SUITABLE WIDTH
TYPE 2.
SUITABLE FOR ANGLES FROM 50° TO 90° CROSSING DRAWN AT 60°
NOTE: ALL TIE PLATES TO BE 8"x¾" EXCEPT AS OTHERWISE NOTED.
TYPE 3.
SUITABLE FOR ANGLES FROM 50° TO 90°. CROSSING DRAWN AT 60°.

Alternate Tie Layouts for Railroad Crossing Angles Up to 90 Deg.

(A) Twenty roads recommend revision of the Manual, while five do not. Reasons for revision are: desirable technical information for readily determining good practice, inclusion in Manual will encourage greater use, and subject will be more readily understood. Reasons against revision are: sufficient to state in Manual, "some of the factors to be considered are, etc. (enumerate)," not necessary, and equilibrium speed should govern. Information covered should be developed in full, but not made available in such manner as to encourage exceeding speeds for which curves are elevated.

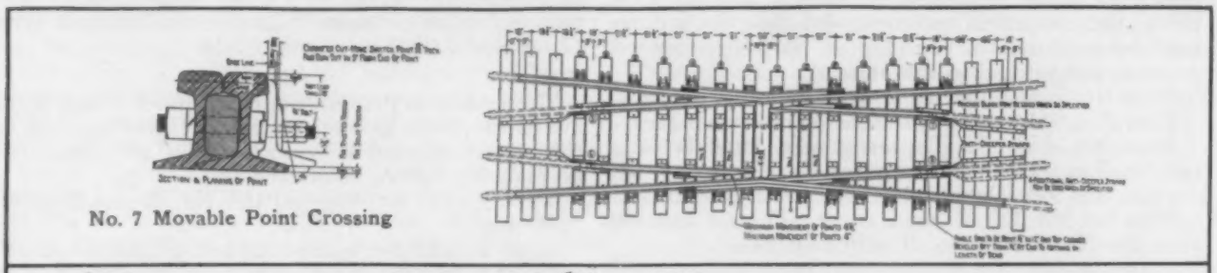
12. (Q) Give a brief statement of your practice in regard to Curve Elevation.

(A) This question was answered in considerable detail disclosing a varied practice on the different roads.

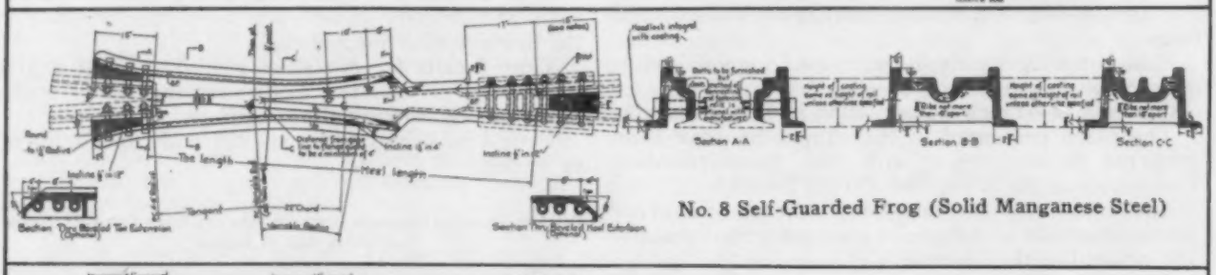
The committee recommended that the report be received as information only and the subject continued.

Appendix C—Detail Plans of Switches, Frogs and Crossings

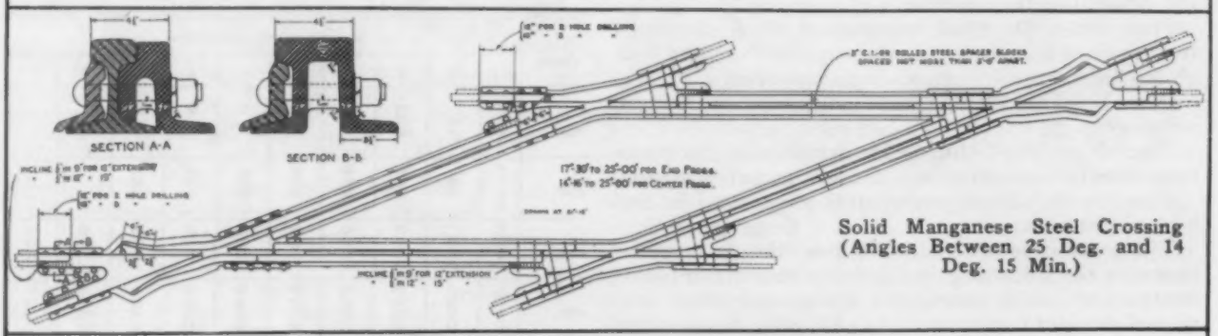
The plans presented in this Appendix and the revisions to the Manual in Appendix A coming under this subject were prepared in conference with the Standardization committee of the Manganese Track Society. Following a series of explanations with ref-



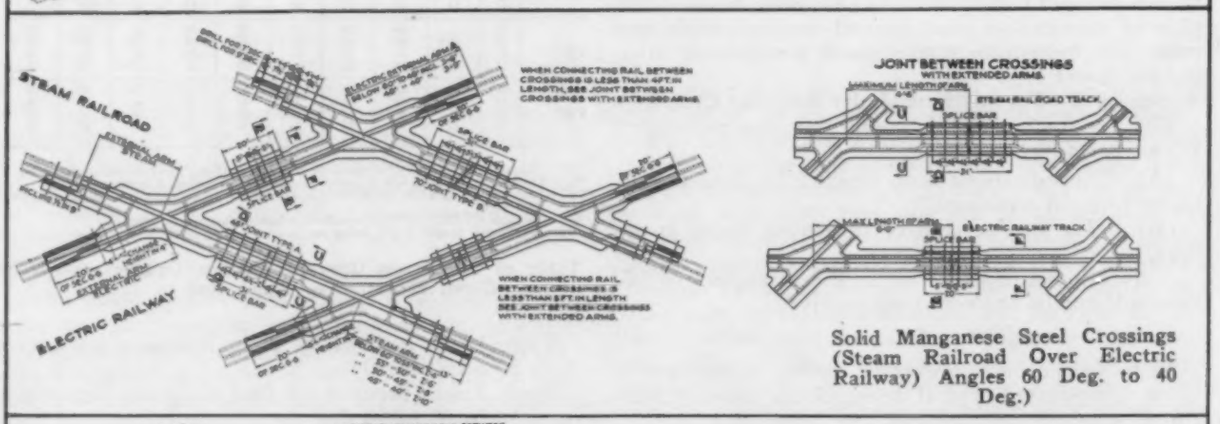
No. 7 Movable Point Crossing



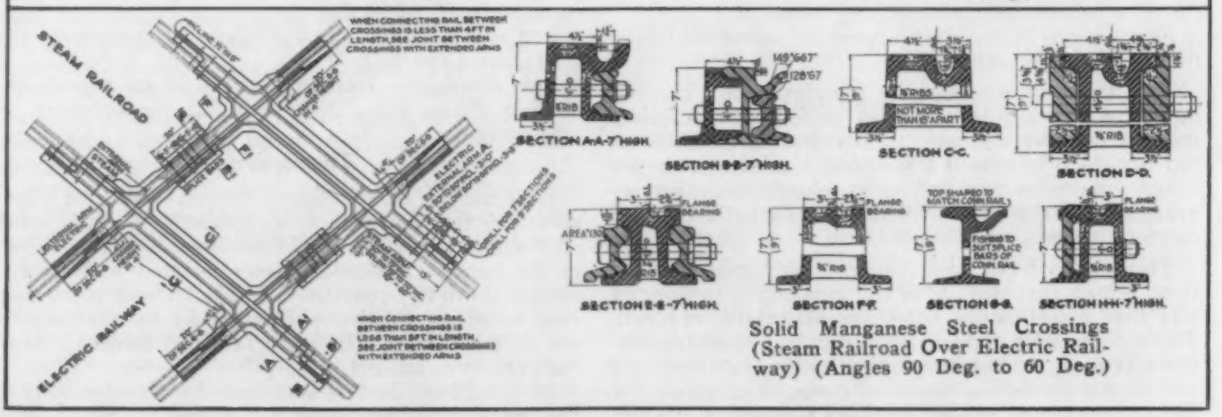
No. 8 Self-Guarded Frog (Solid Manganese Steel)



Solid Manganese Steel Crossing (Angles Between 25 Deg. and 14 Deg. 15 Min.)



Solid Manganese Steel Crossings (Steam Railroad Over Electric Railway) Angles 60 Deg. to 40 Deg.)



Solid Manganese Steel Crossings (Steam Railroad Over Electric Railway) (Angles 90 Deg. to 60 Deg.)

Standard Plans Submitted for Inclusion in the Manual

erence to plans previously presented, and to new plans, the committee recommended that the following plans submitted be adopted as recommended practice and printed in the Manual:

Plan No. 774, Solid manganese crossing.

Plan No. 951, No. 7 movable point crossing.

Plan No. 952, Details manganese knuckle rails for No. 7 movable point crossing.

Plan No. 953, Details movable point crossings.

Plan No. 954, Details manganese railbound knuckle rails for No. 8 and No. 10 slip switches.

Plan No. 643, No. 8 solid manganese self-guarded frog.

Plan No. 640, Standard dimensions for solid manganese self-guarded frogs.

Appendix D—Track Construction in Paved Streets

The plans presented in this Appendix have been prepared in conference with the Standardization Committee of the Manganese Track Society.

The committee recommended that the following plans submitted be adopted as recommended practice and printed in the Manual:

Plan No. 780, solid manganese steel crossings, steam railroad over electric railway, for 7-in. and 9-in. girder rails, angles 90 to 60 deg., inclusive.

Plan No. 781, ditto, except angles 60 to 40 deg., inclusive.

Plan No. 980, Alinement details for turnouts, tongue-switch construction, for use in paved streets.

Plan No. 983, Managanese steel frogs, for 7-in. and 9-in. girder rails.

The committee also stated its intention to consider plans on the following in later reports: Iron-bound manganese insert crossings; manganese steel connected straight tongue-switches for main line use and plan of manganese steel curved tongue-switch and mate for industrial tracks; and iron-bound manganese insert type frogs.

Appendix E—Foundations Under Railroad Crossings

The assignment of this committee was considered in two parts:

(A) "Specifications and designs for foundations under railroad crossings."

(B) "Tie spacing and/or timbering under crossings."

A questionnaire was sent to the engineers of 182 railroads and 62 answers were received.

(A)

Plan No. 721 was presented by the committee to show a suggested typical design for a pre-cast reinforced concrete railroad crossing foundation.

Foundations of this nature were recommended only for angles above 40 deg.

Two types of wooden pile foundation are in use; one in which a pile is driven under each crossing frog to support a heavy timber frame, directly on top of which is placed the railroad crossing; in the other type piles are driven as closely together as practicable, on top of which is placed ballast 12 in. to 15 in. thick.

Those who have used concrete and pile foundations report that the life of the crossing is prolonged and that maintenance costs are materially reduced. The information at hand on structural steel foundations is meagre, but the indication is that they are not as satisfactory as those of concrete or piles.

The committee reported having records of the following foundation installations:

One hundred and twelve concrete (12 railroads), first installation 1916; forty-eight wooden pile (3 railroads), first installation 1921; and six structural steel (3 railroads), first installation 1918.

(B)

The replies to the questionnaire indicate that there are in use three general methods for the spacing of ties under railroad crossings, which are illustrated on plan No. 720-A, submitted.

Type 1 calls for diagonal ties for all crossings up to 90 deg.

Type 2 calls for a large timber, placed longitudinally and directly under each rail of the crossing of the heavy traffic line railroad.

Type 3 calls for cross-ties placed at right angles to the tracks with the ties under the heavy traffic line running through the crossings.

Type 1 was favored by six railroads for angles up to 90 deg.

TABLE OF SPEEDS ON CURVES OF GIVEN DEGREES AND WITH GIVEN ELEVATION OF OUTER RAIL IN INCHES

Degree		Elevation of Outer Rail in Inches								
		0	1	2	3	4	5	6	7	8
1°00' ..	E	.....	32	45	68	78	84	92	.....	.....
	C	68	77	85	98	.....	.....	.....	.....	.....
	S	94	100	.....	.....	.....	.....	.....	.....	.....
	O	.....	.....	.....	.....	.....	.....	.....	.....	.....
2°00' ...	E	.....	26	35	48	55	62	68	.....	.....
	C	48	55	62	68	73	78	83	.....	.....
	S	63	70	75	80	84	90	93	.....	.....
	O	.....	.....	.....	.....	.....	.....	.....	.....	.....
3°00'.....	E	.....	23	33	38	45	51	55	58	61
	C	39	45	50	55	60	64	68	72	76
	S	53	57	61	65	69	73	76	79	82
	O	80	98	100	.....	.....	.....	.....	.....	.....
4°00'.....	E	.....	20	28	33	38	42	45	52	55
	C	33	38	43	47	52	56	58	63	66
	S	43	50	54	57	60	63	66	69	72
	O	83	85	87	90	93	95	98	100	103
5°00'.....	E	.....	18	25	30	35	39	43	46	49
	C	30	35	38	43	46	49	53	56	58
	S	40	43	46	50	53	56	59	62	65
	O	74	76	78	81	83	85	87	89	91
6°00'.....	E	.....	15	23	28	32	36	39	43	45
	C	27	32	36	39	42	45	48	51	53
	S	37	40	43	46	49	52	54	56	58
	O	67	70	72	74	76	78	80	82	84

"E"—Denotes EQUILIBRIUM speed at which centrifugal force is counterbalanced.
"C"—Denotes COMFORTABLE speed—unbalanced elevation 3 inches.
"S"—Denotes MAXIMUM THEORETICAL SAFE speed—resultant of edge middle third.
"O"—Denotes OVERTURNING speed—resultant through gage line.
NOTE.—All speeds are in miles per hour.

Table of Speeds on Curves of Given Degrees and With Given Elevation of Outer Rail in Inches

Type 2 was favored by eight railroads for angles from 50 or 60 to 90 deg.

Type 3 was favored by four railroads for angles from 50 or 60 to 90 deg.

For angles below 50 or 60 deg. all reporting railroads use Type 1.

The committee recommended that its report, including Plans No. 720-A and 721, be received as information.

Discussion

[The report of the Committee on Track was presented by the chairman, J. V. Neubert (N. Y. C.) and all the recommendations of the committee as contained in the various Appendices were adopted without discussion down to Appendix E on foundations under railroad crossings which was discussed by the sub-committee chairman O. F. Harting (Terminal Railroad Association of St. Louis.]

Mr. Harting: In line with one of the suggestions of the President in his address this morning, it may be well to relate the experience of the Terminal Railroad Association of St. Louis with an installation made during

me, 1923 of eight pre-cast reinforced concrete slabs under four 100-lb. manganese insert crossings. At that time the crossings would certainly have had to be replaced within 12 months had the foundation not been installed, but we obtained two years and seven months of additional service. The railroad crossings were bought in 1920 for $5,284. Using this cost and a prolonged life of one year and seven months, an annual saving of $305 was directly traceable to the foundation. The cost of the eight reinforced concrete slabs, including the transportation to the site, with the labor of installation and that of removing the old railroad crossings, excavating for the slabs, installing the slabs, placing the ballast and reinstalling the crossings amounted to about $1,750. The saving due to the prolonged life of the crossings only will pay for the foundation in less than six years time, but the actual saving is considerably in excess of $305 a year, because we have not added the saving due to less frequent railroad crossing renewals, nor has the saving on maintenance been included.

[The report of the committee including the plans was accepted as information, and the committee excused, following which a paper, on Track Recorders, illustrated by slides, was presented by J. de N. Macomb (A. T. & S. F.) This paper is presented elsewhere in this issue.]

A Santa Fe Track Recorder

Major J. deN. Macomb, office engineer, Atchison, Topeka & Santa Fe, presented as a supplement to the report of the Committee on Track a description of a device for recording characteristics of railway track which he developed in collaboration with E. E. Chapman, engineer of tests for the same road.

In its present form, the track recorder consists of mechanisms to record the following information: (1) Low joint record; (2) Track gauge record; (3) Record of lateral movement of truck and car body; (4) Car body inclination and cross level of track, controlled by a gyroscope; (5) Record of time intervals controlled by a clock (from this record, speed may be determined); and (6) Location of landmarks recorded by push button. All this information is recorded by pens on paper, passing over a platen or table.

(1) Low Joint Mechanism

This device consists of a standard six wheel truck under the observation end of the inspection car in which the front and rear axles are rigidly connected by a bar, while the center axle is permitted a free vertical movement with reference to the rigid bar. Any movement below the common level of the outer wheels is recorded and, as the center wheel passes over a low joint, the amount of the depression is indicated. The recording of this movement is accomplished by a series of contact plates affixed to the rigid bar, which are electrically connected to recording pens. A contact brush in the form of a steel roller is fastened to the journal box of the center pair of wheels and is connected to the opposite side of the electric circuit. As the wheel passes over the low joint, the contact brush rolls over the contact plates.

If the joint is ⅛ in. low the brush touches the first plate, the circuit is completed, and this energizes a pair of electro-magnets which operate one of the pens on the record desk. The pen moves laterally, indicating a joint ⅛ in. low. If the wheel drops ¼ in. the contact roller touches the second plate and another electric circuit is closed which operates another pen indicating a joint ¼ in. low, and so on through the series. A similar mechanism is mounted on the other side of the truck and there is a separate set of pens on the recording desk for each rail, three for the right and three for the left.

Trail indicates that low joint measuresments of ⅛ to ⅜ in. on main line track gives satisfactory results whereas, on branch line track, measurements from ¼ in. to ¾ in. at ¼ in. intervals appear to be satisfactory and the mechanism is so constructed that the same three pens may be set to record either either set of intervals desired.

In addition to the record described, the same current also passes through corresponding electro-magnets to actuate mechanical counters, which record the number of low joints of each interval on both sides of the track. By this arrangement the observer is constantly informed of the total number of joints indicated by the individual pens over any given territory.

Track Gage Mechanism

A continuous record of the gage of the track is made by means of two wheels six inches in diameter pressing against the gage side of the head of each rail. These wheels are operated by means of swinging right-angle levers. Spring tension is applied to the levers to hold the wheels against the rails. Similar steel cables carry the movements of the levers to an equalizer bar which eliminates from the final record all movements except actual variation of gage. The gage record is brought to the table mechanically by means of a steel wire, which causes a recording pen to move, making a full scale record.

When the gage recording device is not in service the whole mechanism is lifted upward about four inches by releasing the air on the special piston that carries the frame by which the entire gage recording device is supported.

Lateral Movement Mechanism

By means of the gage mechanism a record of the side movement of the equipment between the rails with respect to the right rail is also secured. The lesser distance between the gage points of the wheel flanges than between the rails permits play in the journal box so that the truck may lurch from one side to the other of its normal position. When the truck lurches to the right, the gage wheels remain against the rails, the levers take a position leaning to the right and the cables also move to the right so that the equalizer bar assumes an inclined position with the right end higher. When the truck lurches to the left the equalizer bar takes a corresponding position with the left end higher. The lateral movement mechanism includes a wire connected to the equalizer bar the right end of which transmits its movement to a pen which makes a record to natural scale.

Cross Level Mechanism

The cross level record is made by means of a gyroscope supported by a bracket attached to the side of the car just above the recording table. The gyroscope stands in a verticle plane longitudinal with the car. The rotors revolve in a vertical longitudinal plane at a speed of 12,000 r. p. m., the right hand rotor turning clock wise and the other counter-clock wise.

To restrain the movement of the gyroscope from its normal position and to bring it back after it has been thrown out by some external force an air balancing device is used which uses air from the train system but which is reduced to eight pounds per square inch. Air flows through a divided pipe in to two cylinders in which pistons work. A similar pipe leads from each

cylinder to two separate port valves. Brackets on the rotor cases are so placed that when the gyro turns from their normal position one of the brackets will cover its corresponding port valve. The port being closed, pressure is set up in the cylinders and the piston moves outward, opening a valve which permits air to flow through a nozzle upon a wheel forcing it to turn. Through a system of gears, the gyro is caused to return to normal position, upon reaching which the port is uncovered and the air stops flowing through the nozzle. As the gyro moves from its normal position and back again, due to inequality of the level of the rails, the record is made by means of electric circuits.

Time, Speed and Location

A clock has been provided with two small pens and two electric contact levers mounted within it in such a way that an electric contact is made at desired intervals, reaching from 10 to 30 sec. This contact closes an electric circuit and operates a time pen which records in offsets from a neutral line on the record. The speed of the train at any instant may be read directly by applying a scale to the record. The pen which records the time intervals is also utilized to show the various landmarks such as mile posts, stations, bridges, switches or road crossings. The circuit which operates the pen for this purpose is closed by means of a push button manipulated by an observer stationed on the rear platform of the car at the instant the landmark is passed. The electro-magnet which causes this record to be made when energized is strong enough to pull the pen toward it even against the pull of the time magnet, so that the landmark record is made on the opposite side of the neutral line from the time record. The observer on the rear platform informs the operator on the desk by means of telephone the identification of the line mark recorded.

The record paper is driven across the table at a rate of 13.2 in. per mile of car run regardless of the speed of the car. This affords a convenient scale which corresponds with standard profile paper. Upon the scale a 33 ft. rail length is approximately 1/12 in. The paper is driven by means of a flexible cable drive from the axle of the truck and reduction of speed is made by the use of gears.

Dr. von Schrenk Talks on Wear of Ties

A SPECIAL feature of the afternoon session was a lantern slide lecture describing the results of an investigation of the cause of the wear or "rail cutting" of cross ties, by Dr. Hermann von Schrenk, consulting timber engineer of the New York Central. In the absence of the illustrations, his talk cannot be given in full. The following is a summary of his remarks:

"We have every reason to anticipate," said Dr. von Schrenk, "a life of treated ties of 30 years or more. That has been realized and abundantly demonstrated abroad, where I saw, for instance, at the International Railway Congress 10,000 creosoted beech ties dated 1871, 1872 or 1873, indicating a life of 50 years. Unfortunately, however, with our present track construction such a life appears to be still far in the future because while we get the same protection from decay that the Europeans do we wear our ties out mechanically or they fail by splitting or checking or other causes.

"The history of tie plates has been sporadic. In the early days the idea prevailed that the rail should move between the tie plates and the base of the rail. That brought about the development of spikes and flanges of all sorts that were supposed to hold the ties. About 1904, due to general failures, a tendency arose, which is prevalent today, of considering the function of the tie plate to be a load distributor. I felt for a good many years that until a proper design of tie plate could be developed it was essential to determine what the factors were that caused the so-called mechanical wear in ties. The slides will illustrate the results of studies made during the past 15 or 20 years and more intensively during the last 2 or 3 years."

Dr. von Schrenk then showed some slides of the bearing areas of ties which brought out the fact that two inches of the wood had disappeared and furthermore that there was no evidence of crushing under the compressive action of the imposed loads. There was no distortion or shifting of the wood fibres. These slides were compared with others showing the distortion that actually takes place when ties are subjected to simple compression as in a testing machine. He also showed a slide of a tie which was protected by a plate that was secured to the tie by two spruce spikes with two independent cut spikes to hold the rail.

"This is one tie we found," he said, "in all of our investigations of this matter in which you will see no lateral shifting of the spring wood. In all other cases the lateral shifting was perfectly evident under these tie plates in which the plate was held more or less rigidly to the tie. There was apparently no lateral shifting, and consequently no mechanical wear."

In further support of this presentation, a number of slides were shown which were obtained by making x-ray photographs of cross tie sections taken under the rail bearing. These brought out in a most interesting way the manner in which the wood fibres are distorted in cases of actual compression and how this distortion was absent in the case of ties taken from actual service.

Dr. von Schrenk also presented some figures on the relative unit bearing loads to which ties are subjected in this country as compared with those on European railroads, for example, 130 lb. for Germany, 174 for Belgium, 192 for Austria, 132 for France and 172 for Italy. "Compare these loads," he said, "with our own, for example, 140 lb. for the New York Central, 119 lb. for the old Lackawanna type and 250 lb. for the Big Four. While they have smaller total loads in Europe, the unit loads are not very far from ours."

To illustrate the manner in which mechanical wear has been avoided on some of the European railroads, a number of slides were shown of European track construction, for example, one of a French railroad showing how shims are introduced which are replaced as they wear out. Another feature illustrated was the use of the rail chair in which the attachment of the chair to the tie is independent of the rail fastening.

He also made reference to the idea of the Lackawanna tie plate with four holes for screw spikes and with separate spikes for holding the rail, commenting on this construction as follows:

"During the past year, acting upon these studies and anticipating the necessity for studying these

bearings, we constructed a number of pieces of experimental track on the railroads with which I am connected. On one piece of track on which the tie plates were worn out, we took the tie plates out and put in creosoted shims. We have in addition to that 30 miles of track in which new rail was being laid with larger tie plates, under which wooden shims were placed as an experiment.

"On the Wabash we finished a small section on which the ties were fastened to independent shims immediately under the tie plate. A similar type of construction has been completed on the Missouri-Kansas-Texas north of Denison, Tex. There are more than 10 of these sections that are now being constructed on the Missouri Pacific, on the New York Central, Nickel Plate and other roads.

"The fundamentals of consideration indicate that there is a load factor, but the load factor is not the only factor we have to be considered. We must actually take into account loadings in combination with the mechanical abrasion.

"We hope to be able to carry on the investigations on a larger scale, not only at the laboratories, but also on various tracks throughout the country."

Remarks by A. N. Talbot

A. N. Talbot (U. of Ill.): The observations we have made during test on tracks brought out conclusions concerning the wear of ties under loose tie plates and tie plates that were held down to the tie, that seemed to have a bearing on the subject matter presented by Dr. von Schrenk. It seems, in part, at least, to offer an explanation of the way the wood acts and the effect of the plates upon the wood. The abrasive action, which has been referred to, has, of course, been observed by all. It is quite evident that the movement of the tie plate comes when the load is lifted from the tie at points between the groups of wheels. When the load is upon it there is probably very slight movement. It seems to me, however, that the breaking down of what we may call particles of the wood through this lateral force coming as it does at the surface and for some distance below, as shown by the slides, is an important feature.

The wood, of course, has little resistance. That brings up the point that under such circumstances, this failure or break-down is due to the heavy loading and separation of the particles by the lateral movement at weak points and the spreading of this separation, we may say under repetition of pressure from zero load to the maximum to any group of wheels. This varying from zero load to the maximum load should be considered an important element in the deteriorating process.

Tie plates for passenger ties should be placed in such a way as to produce and maintain a state of high compression in the wood at the top of the tie. If two screw spikes are put through the tie plate independently of any connection with the rail a compression will be produced in the wood about as great as that produced by the loaded rail. In large part, this compression will be maintained. Of course it will vary. With this initial compression existing in the wood the application of the wheel load will tend to relieve the tension in the screw spike, but will not add materially to the compression in the wood at the upper part of the tie. Thus, there is little or no variation in the compression of the wood fiber at and near the bearing surface. Continuous compression will have very little deteriorating effect on the wood as compared with the repetition from zero to maximum and thus the fatigue effect will be greatly reduced.

I believe that there are other important effects on track maintenance resulting from the fastening of the plate to the tie and that they are shown by our track tests.

Report of the Committee on Ties

Eight reports were submitted by this committee, the most extensive of which was a review of substitute ties and a compilation of current data on test installations. In a report on anti-splitting devices which was submitted as information, a complete resumé was given of the causes of checking and splitting, the amount of this checking that could be expected under varying conditions, and also a review of various types of devices at present designed to prevent splitting. The committee was not prepared, however, to make specific recommendations on this subject. Other reports submitted included those on the proper size of holes for pre-boring and the renewal of switch ties out of face as against individual ties. W. J. Burton has been chairman of this committee for two years and a member for the last 16 years.

W. J. Burton
Chairman

THE committee presented reports covering the following subjects: (1) Revision of Manual (Appendix H). (2) Study of service records (Appendix A). (3) Extent to which A. R. E. A. specifications are being adhered to (Appendix B). (4) Report on substitute ties (Appendix C). (5) Report on anti-splitting devices and specifications for same (Appendix D). (6) Report on proper size hole for pre-boring (Appendix E). (7) Report on renewal of switch-ties out of face by sets as against renewal of individual ties (Appendix F). (8) Report on conference with proper representatives of Federal and state authorities with a view of securing uniformity in annual reports made by the railroads

relating to cross-ties as will permit proper comparison of results obtained by various railroads (Appendix G).

It recommended: (1) That the forms now in the Manual under the heading "Record of Cross-Ties" be withdrawn. (2) That the material under the heading "Installation and Keeping Records of Cross-Tie Test Sections" be supplemented with that portion of Appendix A of this year's report which reads:

"Test sections shall be so devised that all of the variables affecting life, except the one to be determined, will, as far as possible, neutralize or cancel out. Thus, if the effect of size is to be determined, the test should be somewhat as follows:

1. Select a location where all of the ties of both or all sizes may be put in the same track, under the same traffic, rail, etc.
2. Use ties of the same kind of wood for both sizes.
3. Give both sizes the same preservative treatment, or both no treatment.
4. Use identical fastenings and plates.

"If the effect of traffic is to be determined a location should be chosen where on adjacent tracks light, medium and heavy traffic exists and at a point where the traffic on each track can be definitely stated in proper traffic units. Ties of the same size, kind of wood and preservative treatment shall be used and the rail, ballast and fastenings and plates shall be identical in all cases."

(3) That Appendices A, B, C, D, E, F and G be received as information.

The committee also reported that during the past year the Specifications for Cross-Ties and Switch-Ties, adopted last March, were approved and adopted as "American Standard" by the American Engineering Standards Committee.

Committee: W. J. Burton (M. P.), chairman; John Foley (Penna.), vice-chairman; F. T. Beckett (C. R. I. & P.), R. S. Belcher (A. T. & S. F.), M. S. Blaiklock (C. N. R.) W. C. Bolin (B. & O. C. T.), A. M. Clark (N. Y., C. & St. L.), S. B. Clement (T. & N. O.), R. L. Cook (C. of Ga.), E. L. Crugar (I. C.), A. R. Dewees (P. M.), C. P. Howes (T. & P.), C. S. Kirkpatrick (G. C. L.), Frank Lee (C. P. R.), M. F. Longwill (Wabash), W. F. McDonald (C. M. & S. P.), L. J. Riegler (Penna.), J. H. Roach (N. Y. C.), J. S. Ruff (N. Y., N. H. & H.), H. M. Tremaine (N. P.), J. W. Williams (W. P.), R. W. Willis (C. B. & Q.), W. W. Wysor (U. R. & E. Co.), R. C. Young (L. S. & I.).

Appendix A—Continue the Study of Service Records

The question of the cost per maintained mile warrants a very careful study to determine the proper tie to be used. The final result to be sought is the cost per tie per year, and this question must necessarily be determined for each railroad by its own study and investigation.

The principal difficulty results from failure to first determine what desired information requires the test and then to so design and conduct the test as to eliminate all variables affecting life except the one about which data is needed. Relative rather than absolute life should be the aim, because no practical purpose is served by absolute tie-life unless the data is in such shape that the results can be applied with reasonable accuracy elsewhere.

One of the most important questions for which data is required relates to the relative value of ties of different sizes and lengths. It will not do to attempt to compare results with one size, or one wood, and one kind of treatment, in one kind of track, under one kind of traffic, somewhere, with another size, of another wood, and a different preservative treatment, in another kind of track, under another density of traffic, somewhere else in another climate. Any difference in results could as well be ascribed to any one, or any combination of the variables, as to the size alone.

The committee therefore recommended that test sections be so devised that all of the variables affecting life, except the one to be determined, will, as far as possible, neutralize or cancel out. Thus, if the effect of size is to be determined, the test should be somewhat as follows:

(1) Select a location where all the ties of both or all sizes may be put in the same track, under the same traffic, rail, etc.
(2) Use ties of the same kind of wood for both sizes.
(3) Give both sizes the same preservative treatment, or both no treatment.
(4) Use identical fastenings and plates.

If the effect of traffic is to be determined a location should be chosen where on adjacent tracks light, medium and heavy traffic exists and at a point where the traffic on each track can be definitely stated in proper traffic units.

The committee also recommended that test sections be devised under the above-outline principles to secure comparative results as affected by: (a) Size of tie, (b) length of tie, (c) density of traffic, (d) climate, (e) preservation treatment, (f) kind of wood, (g) pre-boring and/or adzing, (h) large and small plates, and (i) cut and screw spikes.

The committee expressed the opinion that tests which have for their purpose the proof of advantages of treatment are no longer necessary.

Appendix B—Adherence to Specifications

The specifications for ties which were adopted in 1926 have had the endorsement of since being adopted as "American Standard" by the American Engineering Standards Committee.

The acceptance of these specifications as the common standards for both consumers and producers has had its effect in improving the situation with reference to adherence to recommended practice. The number of railroads adhering to standards in their specifications for ties increased during last year.

Two trips of observation were again made by the committee during 1926. The inspection of 12 railroads was checked at 9 yards where 5,000,000 cross-ties were seasoning. The ties were representative of those produced in the East and Central West.

So few of the ties examined had been accepted contrary to the requirements of the standard, that the committee is confirmed in its 1925 conclusion to the effect that ties strictly in accordance with the specifications can be had by any railroad which insists on getting such ties, without additional expense. The general excellence of the ties made conspicuous those of the few railroads which accepted undersize and unsound stock. It is incomprehensible why such reckless inspection persists when there is no longer any excuse for it.

A few roads whose ties were examined either do not use the standard size designations or do not mark their ties so as to recognize the size paid for. These non-conformances with the practices recommended as best seem to coincide in most cases with instances of faulty inspection. It is to be expected that an inspector who knows his work is not identifiable after it has been done, and whose size are not those of the "American Standard," will know that his acceptances are not comparable with those of careful workers and will take chances accordingly.

The committee once more urged the user of ties to insist on the delivery of standard ties, in standard sizes, stamped so that the responsibility for the acceptance of them can be placed.

Appendix C—Substitute Ties

Without making recommendations the committee presented a summarized statement of the records of tests on substitute ties now in progress on various roads, these records covering 14 roads and 17 different makes of ties. The report from each road on test installations included the name of the road and party reporting, date of report, kind and make of tie, and a brief statement with regard to each test section covering the condition of the ties, number added or removed since last report, etc.

The only new substitute tie reported as being installed during the past year was reported by the Central region of the Pennsylvania. This is the "Casey Concrete" tie, of which the Pennsylvania installed 500. These ties are of reinforced concrete, 8 in. by 10 in. by 8 ft. long with 7/8-in. reinforcing rods and oak blocks under the rail covered by bent steel plates. Two cylindrical spike blocks are inserted in the concrete at each end of the tie and special spikes 8½ in. long are used.

Appendix D—Anti-Splitting Devices

Checks and splits are caused by unequal shrinkage during the seasoning process. In drying, wood shrinks very little in the direction of its fibers, but it suffers considerable distortion on account of shrinkage in a direction across the fibers. The latter acts in two directions, along the radius and tangential to growth ring. Along the radius the shrinkage may be from four to six per cent and tangentially it is about double that amount.

The table below gives the approximate average radial and tangential shrinkages of woods listed as suitable for cross-ties in the specifications of the Association. It also shows the approximate average shrinkage in volume and the weight per cubic foot, green and air-dried. These figures were deduced from a tabulation in Bulletin 552.

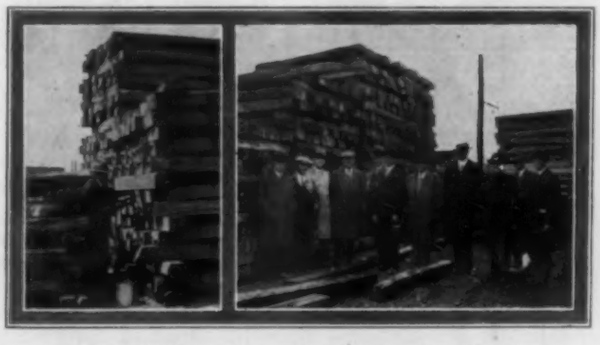
Average Weights and Shrinkage of Woods Used for Cross-Ties

	Weights Pounds per cu. ft.		*Shrinkage from green to air-dry condition, %*		
	Green	*Air-dry*	*Volume*	*Radial*	*Tangential*
Ash	48	39	6.4	2.2	3.5
Beech	55	44	8.1	2.4	5.3
Birch	55	42	8.1	3.4	4.2
Catalpa	—	—	—	—	—
Cedar	34	24	3.7	1.1	2.4
Cherry	38	32	6.1	1.6	4.3
Chestnut	56	30	2.0	1.7	3.4
Cypress	51	34	5.7	1.9	3.0
Douglas Fir	38	33	6.0	2.3	3.6
Elm	52	39	7.1	2.3	4.4
Fira	40	26	5.7	1.8	3.7
Gum	46	36	9.2	3.0	5.7
Hackberry	60	42	6.4	2.0	4.4
Hemlocks	45	30	5.2	1.7	2.7
Hickory	63	51	9.4	3.3	5.6
Larch	46	36	6.6	2.1	4.0
Locust	61	50	4.6	2.2	3.4
Maple	52	37	6.5	2.0	4.0
Mulberry	—	—	—	—	—
Oak—White	62	48	8.1	2.6	4.0
—Red	64	45	7.1	1.9	4.1
Pine	50	34	5.2	2.3	3.2
Poplars	38	28	5.7	2.0	3.4
Redwoods	38	25	—	—	—
Sassafras	41	32	5.1	2.0	3.1
Spruces	34	26	5.8	1.8	3.0
Sycamore	52	50	7.0	2.0	3.0
Walnut	58	44	5.6	2.6	3.5

The amount of water in a green cross-tie depends upon time of cutting. If cut in the summer, it exists in two conditions—free water contained in the cell cavities and water absorbed in the cell walls. Ties cut in the winter contain little free water. Removal of the excess, or free water, has no apparent effect upon the properties of wood, except to reduce its weight. Shrinkage usually does not take place until the absorbed water is being removed. The wood dries first on the surfaces, particularly at the ends, from which transfusion is greatest. When the absorbed moisture leaves the cell walls, the walls contract. The ends of the tie dry more rapidly and begin to shrink before the material near the center of the tie. Thus the cross-section at the ends is actually less than toward the center of the tie. The tendency to reduce the area at the end sets up tensile stresses across the grain of the wood. When these stresses become greater than the strength of the wood across the grain checks occur.

While accurate records are not at hand, it seems certain that split ties come out of track in a much shorter time than the normal ties; also, that splitting sets up decay, especially when penetration of preservative treatment is not great. Unless the split is so located as to reduce the holding power of the spike, the failure will usually be classed as decay, whereas the early decay may have been caused by the split. It seems certain also that ties that fail by splitting are usually taken from track in the early stages of their life and thus the loss of life of such ties is relatively large.

The early application of anti-splitting devices will save many ties that otherwise would become split.



The Tie Committee in an Eastern Tie Yard

The preferable time for application is when the tie is manufactured. This cannot always be accomplished, as it is well to inspect and ship ties to the treating plant as promptly as possible after they are delivered on right-of-way. The most practicable place for application is at the treating plant when stacked for seasoning. At that time the ends of the ties are most easily inspected and irons can be driven at least cost.

All broadleaved woods are inclined to check and require anti-splitting devices. Needleleaved woods do not check sufficiently to warrant application. Both ties intended for use and untreated and treated should be ironed, as the checking will usually occur during the pre-treatment period of seasoning.

There are several devices in use to prevent splitting but the committee is not prepared to make recommendations this year on the relative merits of the several shapes or of the details of the cutting edges.

Corrosion is another matter that has been under discussion. In zinc chloride treated ties it is very bad. It occurs also in untreated ties and after some years in creosoted ties. Recently the use of copper-content steel has given promising results, but the committee expects to make further investigation regarding corrosion.

The ordinary types of anti-splitting devices cost

from $6 to $8 per thousand for material, and from $5 to $7.50 per thousand for application.

Checking can temporarily be prevented by the application of moisture resistant end coatings. The two best cold coatings developed at the Forest Products Laboratory are hardened gloss oil thickened with barytes and asbestine (very cheap), and high-grade spar varnish and barytes (expensive).

It is possible that the application as a temporary measure of such cold coatings at the time of manufacture of the tie would be warranted where ties are shipped long distances or where considerable time is to elapse before the ties are placed in the treating yard.

Appendix E—Size of Holes for Pre-Boring

The pre-boring of cross-ties is considered good practice by a considerable number of railroads and in the last few years there has been a large increase in the number of boring and adzing machines in operation at wood preserving plants.

Inasmuch as ties of many different woods are bored, some variation in practice is to be expected. Information as to the size of hole bored for each size of spike, obtained from roads pre-boring ties is summarized as follows:

⅝" Cut Spike Hardwood No. Reporting 16		⅝" Cut Spike Softwood No. Reporting 17		¾" Cut Spike Hardwood No. Reporting 5		¾" Cut Spike Softwood No. Reporting 6	
Size Hole	No. Using	Size Hole	No. Using	Size Hole	No. Using	Size Hole	No. Using
9/16"	1	9/16"	3	11/16"	1	11/16"	4
5/8"	7	5/8"	10	3/4"	4	3/4"	2
11/16"	8	11/16"	4	13/16"	0	13/16"	0
	16		17		5		6

Sizes of Holes Used in Pre-boring for Spikes

It will be noted that most roads bore a hole 1/16 in. smaller than the cut spike in hardwood, and 1/8 in. smaller in softwood. However, in the case of 5/8-in. cut spikes in hardwood ties the practice is almost evenly divided. One road reports using the bits first in hardwood ties and after they begin to show some wear using them in softwood. All roads using screw spikes bore the same size as the core of the spike with the exception of one which bores 1/32 in. less than the core in pine ties. Most of the roads pre-boring for spikes bore entirely through the tie.

Tests heretofore reported demonstrate that much less mutilation of the wood fiber results from driving a cut spike in a bored hole than results when a cut spike is driven in the solid wood, and that the resistance to withdrawal of a cut spike driven in the bored hole is greater than when driven in solid wood. Opinion is general that more resistance to the lateral pressure of the rail flange is offered by bored holes, as the spikes have a solid backing instead of being surrounded by torn and broken wood fibers.

The committee is of the opinion that while it is desirable to ascertain which size of hole offers the greatest resistance to withdrawal of spike, it is even more important to ascertain which size of hole offers the greatest resistance to the horizontal pressure of the rail flange, and that both should be considered in determining the proper size.

The committee will have additional information on this subject to submit next year after tests under way are completed.

Appendix F—Renewal of Switch Ties Out of Face Versus Individually

A questionnaire was sent out, and a selection made of those railways most closely in touch with the several members of the sub-committee, the total mileage covered being approximately 180,000 miles. The answers to the questionnaire developed that there was no uniform practice in the renewal of switch-ties, and that renewals in complete sets, and renewals by individual ties were almost equally divided as to mileage and number of railroads. Generally there is no difference in the practice as to renewals with different kinds of wood, or in the practice of renewing switch-ties on main lines, branch lines, or sidings.

The question of the most economical method of renewal developed the fact that individual replacements are considered the most economical by the majority of the railroads reporting, but generally the details of the saving to be effected appear to be based upon general observation rather than specific data.

Replies to the question, "Which practice do you recommend and why?" brought out the fact that there is considerable diversity of opinion as to the benefits of the two methods of renewal.

It is claimed by its exponents that the out-of-face method results in more uniform bearing and stronger foundation for the turnout, and less disturbance of the ballast. The individual replacement method is claimed by those favoring it to result in greater economy, more uniform strength, and insuring the full life of all the material.

The committee stated its desire to give the subject further study before making recommendations.

Appendix G—Conference With Federal Authorities on Cross-Ties

The reports made annually to the Interstate Commerce Commission by the railroads contain certain data, under Schedule 513, relating to tie renewals. Most, if not all, of the states require practically identical information, the state forms being identical with the interstate.

As previously reported, this data did not permit of the proper determination of the number of ties renewed per mile of maintained track, which average the committee considers a good index, taken together with traffic data, as to the relative ultimate economy resulting from the differing tie renewal practices and policies of the railroads.

The committee conferred with the Bureau of Statistics of the Interstate Commerce Commission and made detailed recommendations as to modification of Schedule 13. The modifications proposed include:

(1) The miles of track maintained, corresponding with the renewals.

(2) The estimated total cross-ties in the maintained mileage.

(3) The estimated miles of track occupied by bridge or switch-ties, or other construction, where no cross-ties are used.

(4) The approximate percentages of treated ties treated by each of the processes used.

The committee has received advice from the Director, Bureau of Statistics, that its recommendations had been adopted and would appear in Annual Report Form A for 1927. It is expected that the several states will adopt the revised I. C. C. forms without further action on the part of the committee.

Discussion

[The report was presented by Chairman W. J. Burton (M. P.). The outlines of Appendices A, B, C, D, E and F were presented by the chairmen of the various sub-committees and were received as information without discussion.

Chairman Burton presented the report on the revision of the Manual and *the motions made that the committee's recommendations on this subject be adopted were carried*, following which the committee was excused.]

Report of Committee on Signals and Interlocking

This report includes a complete summary of the activities concerning automatic train control during the past year. A statement and table explain the mileage of different types of train control in service and the report describes other tests being made on different roads. Following a brief statement of the work of the Bureau of Signals and Train Control the report gives a list of the criticisms of the reports issued by this body, following inspections of train control installations by engineers of the bureau. These comments are of importance as they form the only gage the railroads have for determining whether their installations are acceptable to the commission. F. B. Wiegand, signal engineer, New York Central, Lines West, has been chairman of this committee for four years.

F. B. Wiegand
Chairman

THE committee submitted reports on: (1) Automatic train control, Appendix "A", presented as information; (2) signals for highway crossing protection, a summary and progress report, and (3) signaling, Appendix "B" which included as information a list of all propositions by the Signal section, A. R. A., approved by letter ballot in 1925 and 1926.

Committee: F. B. Wiegand (N. Y. C.), chairman; B. T. Anderson (C. & O.), vice-chairman; H. S. Balliet (N. Y. C.), W. E. Boland (S. P.), W. J. Eck (Sou.), W. H. Elliott (N. Y. C.), G. E. Ellis (A. R. A.), J. V. Hanna (K. C. T.), J. C. Mock (M. C.), H. G. Morgan (I. C.), F. P. Patenall (B. & O.), J. A. Peabody (C. & N. W.), F. W. Pfleging (U. P.), W. M. Post (Penna.), A. H. Rudd (Penna.), Thos. S. Stevens (A. T. & S. F.), E. G. Stradling (C. I. & L.), W. M. Vandersluis (I. C.), and R. C. White (M. P.).

Appendix A—Automatic Train Control

The last report on train control gave a list of available devices which was prepared by the United States Railroad Administration committee, and the standing of each was briefly described. There have been some additional devices proposed; some have been tested out, but others have not reached the stage of trial at the present time. A number of plans have been presented to the Interstate Commerce Commission for examination, but only a comparatively few were found to possess sufficient merit to warrant consideration. At the present time, the installations being made by railroad companies to comply with the two orders of the commission may be divided into two distinct classes: intermittent and continuous. Of the first there are six types or variations, and five of the second. The first class includes the two ramp installations installed on the Chicago & Eastern Illinois and on the Rock Island; the intermittent induction devices of the General Railway Signal Company, and of the Union Switch & Signal Company, and the magnetic induction devices of the National Safety Appliance Company and of the Sprague Safety Control & Signal Corporation. The continuous devices include the two-speed continuous of the General Railway Signal Company and the two and three-speed continuous of the Union Switch & Signal Company; the continuous stop of each company may also be put into this class. In addition to these, experiments under service conditions are being conducted by the Miller Train Control Corporation with an intermittent type. The Regan Safety Devices Company is also making a trial installation with one of the same character. A continuous device with high frequencies, similar to those used in radio work, is being tested by the Continuous Train Control Corporation, using the principles developed under the Clark system, which has been in process of development for a number of years. Tests are also being continued on the Webb device controlled by the International Signal Company. A recent development of the continuous type is the so-called "Coder" system, by which the impulses are sent over the rails in a certain ratio. This was designed to secure immunity from outside interference and also provide a system which would be operative both in steam territory and electrified territory. After this system was designed, it was accepted as a basis for providing interchangeability by the roads in the eastern territory using the continuous system.

I. C. C. Orders

The commission has required no additional roads to install train control, nor has it issued any general orders since our last report. A number of individual petitions have been presented to the commission by different carriers asking for extensions of time, exemptions, minor changes in limits of territory, relating to the use of branch line locomotives on main lines, and substitution of the installation of automatic signals for the train control. In most cases the commission has issued orders answering these petitions without hearing, other than the presentation by the officials of the road concerned before Division 1 or the Director of the Bureau of Signals and Train Control Devices. The majority of the petitions for extension of time have been granted on both first and second orders, although none has been extended beyond January 1, 1927. The changes in territory have in most cases consisted of modifications to prevent complications at terminals, although in one case where there was rather an extensive section of joint track, about 50 miles was eliminated from the second order territory. No exemptions have been granted during the year, but several roads have had the time of completion suspended until further orders. In two cases in which substitution of signals was permitted for train control, the carriers con-

cerned presented an elaborate program, which was started upon at once.

The recurrent acknowledgment was the subject of a petition by the Oregon-Washington Railroad & Navigation Company and the proceedings were participated in by other roads interested in the same device. After consideration, the commission advised under date of March 9, 1926, that this provision in the final reports will be eliminated.

An extensive hearing was held before the commission at the instance of the Sprague Safety Control & Signal Corporation referring to certain relations as to a contract it had with the New York Central. The commission in its decision on May 14, 1926, dismissed the complaint.

While no order has been issued, the requirement in some of the early reports on installations using permanent track magnets to use some means of detecting the removal of the magnet, has been omitted in later reports.

Progress

As of November 30, 1926, the number of roads required at present to make an installation is 44 under the first order, 5 having been exempted or having had their time for completion indefinitely postponed. Under the second order, 11 roads have been exempted or have had the time of completion suspended, leaving 36 roads which are required to make the installation. Under the first order all but 6 roads have completed their installation, and work is well under way on those. On the second order, 18 roads have finished their installation and work is in progress on the remainder. There have been some minor changes in the mileage involved, the total now being 7,643 miles of track in place of 7,769, as last reported. The second order totals 7,409 miles of track, although there may be some readjustments which will change this total a small percentage, as well as in the number of locomotives. Exhibit A (not shown) gave the mileage as last reported for the first and second orders, together with the number of locomotives. In some cases all the locomotives required for both orders are included in the first order.

I. C. C. Inspections and Approvals

Since the permanent installations are being completed, the commission has discontinued the practice of making inspections of preliminary installations and reports. Only one was made during the year 1926, which makes 20 in all. A complete list was included as Exhibit B (not shown here.)

Three inspections of complete installations under the first order had been made at the time of the last report, and 25 more have now been made, making 28 in all. Reports have been issued on 22 of these. On the second order, 8 inspections have been made and reports have been issued on 3.

All the reports follow the same form. The installation is described briefly, giving the extent, signaling, and in some cases, other features of the installation. This is followed by a brief description of the device with its method of operation. In all except the first 3 reports, the cost of the installation, including changes and additions to the signal system as reported by the road, is given. In only a few cases has an unqualified approval been given, but "exceptions" are noted, which are followed by a list of "requirements," "recommendations" or "criticisms," as they are variously called, generally referring to the manner of installation or maintenance and usually of less fundamental importance than the "exceptions." The reports quite generally conclude with the statement that the company "is expected to promptly and currently inform us of the progress made in conforming to all of the above-stated requirements and recommendations." This seems to include the exceptions, as well as the list of less prominent criticisms.

In Exhibit C (not shown here) gives an abstract of the exceptions, requirements and recommendations made in each of the reports issued. These have been briefed, but give the essence of the criticism in each case.

Copies of these reports are prepared for distribution by the Committee on Automatic Train Control of the American Railway Association and supplied to the officials of the roads concerned. Additional printed copies may also be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., by quoting the opinion number which is given for all of these that have been printed.

Analysis of Accidents

In our last report we gave an analysis of the accident record as shown in Bulletin 93 of the Interstate Commerce Commission for the year 1924. Bulletin 94, for the year 1925, shows a slight increase in the number of non-trespassers killed, with, however, exactly the same number of collisions. The number of collisions per million locomotive miles was slightly decreased, but the percentage of those due to collisions to all deaths of non-trespassers was increased from 2.5 per cent to 2.8 per cent. There was a slight decrease in the number of collisions involving casualties. Diagrams in the report show a decrease in the number of passengers injured per passenger mile, but a slight increase in the number killed, although the latter number is materially below the high point of a few years ago. The number of trainmen injured per 1,000 in service shows a slight decrease, except in yard service where there is a slight increase.

For the past five or six years, the commission has published a diagram showing the fatalities from about 20 causes due to railroad operation. The deaths from collisions of all persons is seventh on the list; that is, there are six causes accounting for more deaths than collisions, collisions amounting to 1.95 per cent of all deaths for the year 1925. Omitting trespassers and including passengers and employees, collisions drop back to sixth place as a cause of fatalities, and occupies fifth place for employees only, with percentages of 2.89 and 5.69 respectively. In each tabulation, however, derailments are responsible for more deaths than collisions.

These diagrams and tables show the relative small number of deaths that might be saved by automatic train control (even assuming that all collisions could be prevented by train control, which is not a fact), and also that the railroads themselves, by the generally improved rate per train mile or per 1,000 employees in service, are taking effective steps to reduce the accident record.

Discussion

[The report was presented by Chairman F. B. Wiegand (N. Y. C.). Appendices A and B were received as information and the committee reported progress on the subject of highway crossing signals after a number of conferences with the Committee on Grade Crossing Design, Protection and Elimination. There being no discussion the committee was excused.]

American Railway Engineering Association Registration

A TOTAL of 547 members and 221 guests or 768 persons in all registered at the American Railway Engineering Association convention yesterday. This compares with a total of 554 members and 122 guests or a total of 690 on the opening day last year.

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Beck, Edward, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.
Benson, C. B., asst. prof., Purdue University, West Lafayette, Ind.
Beranger, A. A.
Berninghaus, J. A., mgr., Monsanto Chemical Works, St. Louis, Mo.
Betton, E. L., Kansas City, Kan.
Bill, E. M., General Electric Co., Schenectady, N. Y.
Bischoff, J. M., T. R. R. A. of St. L., St. Louis, Mo.
Bishop, E. N., insp. water supply, C. & O., Huntington, W. Va.
Blackwell, J. H., roadmaster, Southern, Asheville, N. C.
Blaiklock, H. M., asst. to dis. engr., C. N. R., Montreal, Que.
Bowen, H. D., Barboursville, W. Va.
Bowers, A. O., H. V., Columbus, Ohio.
Brady, W. F., signalman, C. & O., Barboursville, W. Va.
Brenton, R. S., draftsman, A. T. & S. F., Duluth, Minn.
Brightwell, J. L., supvr. track, C. & O., Huntington, W. Va.
Brode, K. L., transitman, A. T. & S. F., Newton, Kan.
Brock, M., Lexington, Ky.
Brooke, C. H., Conley Frog & Switch Co., Chicago.
Brown, I. L., gen. for. b. b. & w. s., Arkansas City, Kan.
Brown, W. B., Southern, Charlotte, N. C.
Caldwell, J. J., mast. carp., Penna., Clayton, Ill.
Cayley, W., B. & B., master, C. N. R., Stratford, Ont.
Carter, L. F., Sperry Gyroscope Co., Brooklyn, N. Y.
Chapin, P. E., asst. cost engr., C. & O., Peru, Ind.
Church, S. R., consulting chemist, New York.
Clark, G. T.
Clark, H. A., gen. mgr., M. & W., Muncie, Ind.
Colman, Charles, Erie, Ridgwood, N. J.
Corkhill, R. K., A. T. & S. F., Topeka, Kan.
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Cress, E. E., University of Illinois, Urbana, Ill.
Cretcher, J. C., asst. engr., G., C. & S. F., Galveston, Tex.
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Crist, H. E., asst. engr., G. N., Willmar, Minn.
Crump, J. T., asst. engr., C. & O.
David, T. H., prin. asst. engr., Indianapolis Street Railway Co., Indianapolis, Ind.
Davies, W. P., asst. engr., M. P., St. Louis, Mo.
Dey, V. A. G., div. engr., C. P., Toronto, Ont.
Dice, A. T., Jr., supt., Reading, Reading, Pa.
Disbrow, C. A., Rail Joint Co., New York.
Dixon, J. H., Alberta Wood Preserving Co., Ltd., Calgary, Alta.
Donahoe, T. F., gen. supvr., B. & O., Pittsburgh, Pa.
Doran, C. S., pres., Sperry Gyroscope Co., Brooklyn, N. Y.
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Eckhardt, W. F., ch. maint. clk., C. R. I. & P., Rock Island, Ill.
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Ericson, C. T., Toronto, Ont.

Fairlie, T. U., Hydro-Electric Power Co., Toronto, Ont.
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Farming, L. M., asst. engr., Erie, New York.
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Folsom, C. D., Boston, Mass.
Freygang, A. H., div. engr., B. & O., Arkon, O.
Fritch, E. H., Jr., asst. to secy., A. R. E. A., Chicago.
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Gillett, L. A., struct. engr., F. E. C., St. Augustine, Fla.
Grubbs, L. A., C. & O., Clifton Forge, Va.
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Hicks, P. R., American Wood Preservers' Assn., Chicago.
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Hill, William, insp. w. s., M. P., Osawatomie, Kan.
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Lichty, C. A., insp., C. & N. W., Chicago.
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McDowell, Lewis, Deckert & McDowell, Chicago.
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McRee, C. A., div. engr., S. A. L., Raleigh, N. C.
Menard, J. P., div. eng., C. N. R., Quebec, Que.
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Michel, William, ch. engr., H. V., Columbus, O.
Miller, C. F., supvr., Penna., Gallitzin, Pa.
Mitchell, George, supvr., B. & O., Hamden, O.
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Mosher, W. T., asst. engr., Southern, Knoxville, Tenn.
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Osterland, G. R., Barrett Co., Chicago.
Otto, J. B., Jr., supvr., Penna., Barnesboro, Pa.
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Perkins, H. E., asst. div. eng., B. & O., Wheeling, W. Va.
Peters, G. O., div. engr., M. P., St. Louis, Mo.
Perry, J. E., asst. prof. R. R. eng., Cornell University, Ithaca, N. Y.
Piesch, Henry, asst. engr., U. P., Omaha, Neb.
Popejoy, C. F., supvr. w. s., N. P., Atchison, Kan.
Porter, H. F., gen. for. of reclam., Penna., Trafford, Pa.
Pulford, William, roadmaster, C. N. R., Guelph Junction, Ont.
Raussan, W. J., asst. engr., M. P., St. Louis, Mo.
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Rockenbach, H. R., supvr., Penna., Steubenville, O.
Romanowski, Joseph, A. R. A., Chicago.
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Seitz, R. P., asst. b. & b., supvr., N. P., Livingston, Mont.
Shatwell, E. V., sig supvr., C. & N. W., Chicago.
Shoemaker, G. W., div. engr., S. A. L., Tampa, Fla.
Shotwell, E. V., sig., supvr., C. & N. W., Chicago.
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Simmons, R. C., Boston, Mass.
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Simpson, V. B., roadmaster, C. R. I. & P., Eldon, Mo.
Smith, A. G., elec. engr., B. & O., Boston, Mass.
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Smith, O. M., supvr. track, C. & O., Logan, W. Va.
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Stuart, J. C., mgr., railway insp., Robert W. Hunt Co., Chicago.
Symington, T. H., Baltimore, Md.
Symington, T. R., Baltimore, Md.
Talman, H. S., asst. engr., C. & O., Richmond, Va.
Tattershall, E. R., div. engr., N. Y. C., Watertown, N. Y.
Taylor, A. B., pres., Taylor-Colquett Co., Spartanburg, S. C.
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Todd, J. N., office engr., Southern, Washington, D. C.
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Trimble, W. A., asst. supvr., Penna., Tyrone, Pa.
Trites, W. E., roadmaster, C. N. R., Capreol, Ont.
Truman, A. B., div. engr., A. T. & S. F., East Las Vegas, N. M.
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Wakefield, H. W., asst. engr., N. P., Livingston, Mont.
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Woodrum, H. B., instrumentman, C. & O., Peru, Ind.
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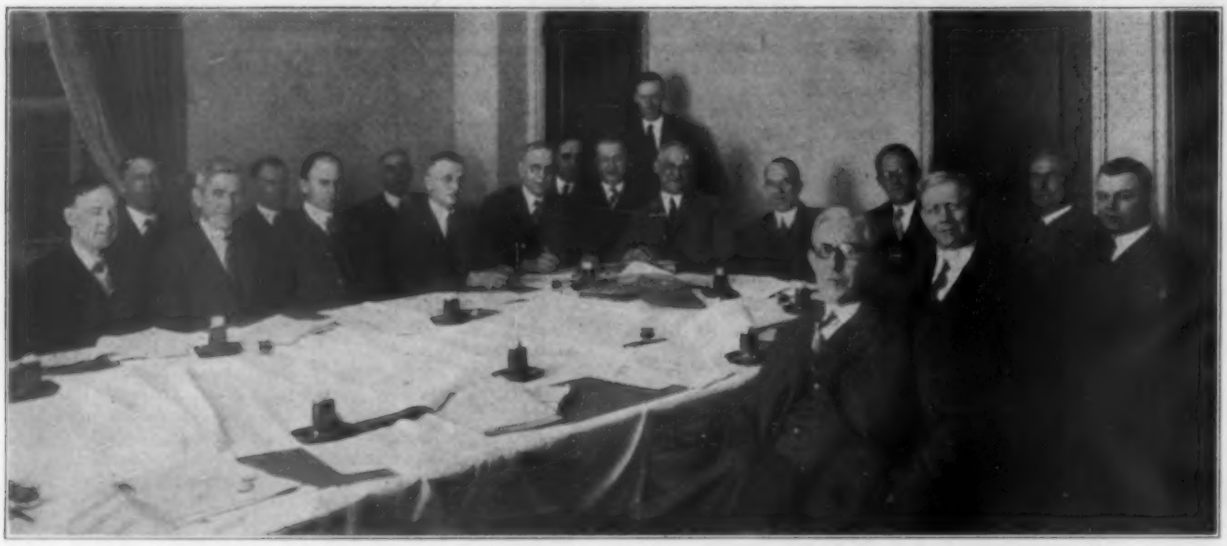


The Board of Direction Met Sunday

Second Day of Signal Meeting Busy

Four committee reports, election of officers and study of car retarders feature closing day's session

THE second day of the annual convention of the Signal section, A. R. A., at the Palmer House, opened at 10 a. m. yesterday morning by A. H. McKeen (U. P.), chairman. During the day six committee reports were presented and two sets of motion pictures were shown illustrating the operation of car retarders in hump yard operation. Following the election of officers, as told in detail elsewhere in this issue, the meeting adjourned at 4 p. m. The 1927 stated meeting is scheduled to be held at the Mount Royal hotel, Montreal, Que., on September 13, 14 and 15. The new chairman, C. H. Tillett, will preside.

Report of Committee III—Power Interlocking

Increased interest is being evidenced in the use of automatic signals instead of complete interlocking plants with derails for the protection of railroad grade crossings. On the average such an automatic layout will permit a saving of about $5,000 a year in levermen's wages alone, as compared with an interlocking requiring a leverman on each trick. In order that these so-called automatic signaling interlockings may be constructed along the same lines throughout the country so as to promote safety and economy of operation the committee prepared a report outlining and defining the fundamental features and circuits to be employed. F. W. Pfleging, signal engineer of the Union Pacific, has been chairman of this committee for six years, and was chairman of the Signal section in 1921.

F. W. Pfleging
Chairman

THE committee submitted for consideration and discussion a report on the following subject: Automatic crossing protection at railroad crossings.

Automatic Crossing Protection at Railroad Crossings

1. **Speed restriction.**—(a) Approaching crossing, miles per hour; (b) At crossing, miles per hour.

2. **Release.**—(a) Time release to permit setting of opposing routes and clearing other routes; (b) Push button release for switching or reverse movements.

3. **Approach signal.**—(a) Approach warning sign; (b) Inoperative approach signal; (c) Operative approach signal.

4. **Smash board.**—(a) Required; (b) Not required.

5. **Home signal.**—(a) One-arm; (b) Two-arm; (c) Three-arm.

6. **Normal position of signal.**—(a) Home signal; stop; (b) Approach signal; caution.

7. A signal permitting a train to proceed must not be displayed unless the signals on the opposing or conflicting route display their most restrictive indication.

8. Clearing section must be of such length as to permit the clearing of the crossing signal at stopping distance from the signal.

9. Home signals must be located not less than 500 ft. and not more than 800 ft. from the crossing.

10. Each operative unit must be controlled by independent battery and circuit.

Committee: F. W. Pfleging (U. P.), chairman; E. T. Ambach (B. & O.), vice-chairman; W. C. Sibila (N. Y. C.), vice-chairman; F. J. Ackerman (K. C. T.), T. A. Allan (C. N.), R. B. Amsden (I. C.), D. W. Fuller (A. T. & S. F.), T. Holt (C. U. S.), J. H. Oppelt (N. Y. C. & St. L.), E. B. Pry (Penna.), C. D. Rex (Sou.), T. C. Seifert (C. B. & Q.), I. A. Uhr (St. L.-S. F.), O. R. Unger (M. P.), and G. A. Ziehlke (U. P.).

Discussion

Chairman F. W. Pfleging (U. P.): On 3, Automatic Signal Protection at Railroad Grade Crossings, the committee thought that speed restrictions should be placed at approaching crossings where fixed caution indications are used, or where no fixed caution indications are used, but an advance warning sign.

The push button release is for switching movements, and for a follow-in movement where the crossing protection signal is also an automatic block signal.

T. S. Stevens (A. T. & S. F.): Has the committee given any consideration to the complications in applying this push button release? In discussing an actual installation to be made, we concluded we might just as well let the men flag through the place.

Chairman Mr. Pfleging: On double track, the Stop and Proceed would be satisfactory. But it would entail a delay of probably 40 to 50 min. to flag through a single track block signal.

Mr. Stevens: Not if a proper signal was installed in advance of the interlocking signal.

Chairman Pfleging: In the case I referred to, it would have made the rearrangement of the signals necessary between the two passing tracks and installation of an extra set of intermediate signals.

The committee finds only one state, Minnesota, that is requiring a smash board where automatic crossing protection is installed. Five state commissions do not require it.

A. H. Rudd (Penna.): If there was ever a snare and a delusion, it is an inoperative approach signal, and I hope the committee will never advocate it.

We use smash boards at draw bridge in the State of New Jersey. The State regulations require that we must put in derails if we want to run at speed. If we want to run at very slow speeds, we can put in smash boards.

J. A. Peabody (C. & N. W.): We can make an installation of this automatic signal control for crossings in outlying territories, putting in fixed distant signals and depending on the operating department to check up their men and discipline them if they do not properly obey them and do it at an expense of just about one-half of what it would cost us if we put in the operative approach signal. I think it is worth while.

R. B. Elsworth (N. Y. C.): We formerly used a good many smash boards but we found them difficult to maintain and have eliminated all of them, except at one or two points.

Mr. Stevens: I would like to get the sense of the meeting on this question. I move the elimination of 4.

C. A. Christofferson (N. P.): I do not think that clause should be eliminated, but I would like to see it as stated, "that smash boards should be used only where public authorities require them." I consider it an unnecessary evil and an expensive luxury. For an ordinary single track crossing, it adds about $800 per signal, and makes the circuit very complicated besides causing a lot of trouble. What good is an operative distant signal outside of automatic territory? The home signal is normally at Stop, so unless you put a clearance circuit in a couple of miles beyond the distant signal, the distant signal would always be at Caution, so it might as well be fixed.

Mr. Stevens: I would make it a sign and not a signal. I am interested in seeing this section stamp its disapproval on smash boards.

Chairman McKeen: Would it strengthen it, Mr. Stevens, to say that smash boards should not be installed except where required by public authorities?

Mr. Stevens: No, sir, I would not mention them.

Chairman McKeen: That might infer that we were overlooking them.

Mr. Christofferson: We would not have secured the authority to put in these crossings except that the Signal section had gone on record in saying that derails should not be used except where compelled by public authorities.

Mr. Rudd: I hope the committee would not advocate an inoperative approach signal. We have some and we have taken a number out. What we do instead is to put in an approach warning sign.

Chairman McKeen: Is there a second to Mr. Stevens' motion that four be eliminated? (*Motion was carried.*)

Mr. Elsworth: I move, for the information of the committee, the elimination of 3 (b). "Inoperative approach signal." [*The motion was carried, by a vote of 47 to 27.*]

L. Wyant (C. R. I. & P.): If you eliminate (b) and (a), we are up against a stiff proposition. It is not practicable at outlying crossings to use an operative distant signal which extends an approach section back into yards and switches or other crossings. The elimination of both (a) and (b) would seriously retard the opportunities for using the automatic interlocking.

Mr. Peabody: It is absurd to cut out smash boards from this list. Some states require it. You can use (a) and/or (b). I would like to see all of these motions withdrawn and the committee instructed to put in the list everything that is to be considered in connection with this subject.

R. M. Phinney (C. & N. W.): At least two roads in the middle west developed the idea of using a slow speed arm leaving the high speed arm fixed.

Mr. Wyant: I think that 500 ft. requirement should be lowered. With proper speed restrictions 300 ft. is not too short.

Mr. Peabody: Mr. Wyant is right.

C. J. Kelloway (A. C. L.): I would suggest the elimination of 9. [*Motion carried.*]

Mr. Peabody: Mr. Chairman, I do not quite see the necessity of independent battery and circuit. *I move that* 10 *be eliminated.*

Mr. Stevens: The first accident at an automatic interlocking plant will mean its condemnation, and we all know that we can get crosses if we have a common battery that will give us false clear indications. We are

arranging our buildings so we can isolate all circuits on the four different tracks involved.

E. G. Stradling (C. I. & L.): It would serve our purpose if the batteries and the circuits for the units on one track were independent of the batteries and the circuits for the units on the crossing track. [*The motion to eliminate paragraph* 10 *was carried.*]

Mr. Pfleging: The committee wishes to change that to read: "Each conflicting unit must be controlled by independent batteries."

Report of Committee XI—Chemicals

Primary batteries are used for track circuits or signal operation, or for both purposes on perhaps the majority of automatic signals now in service. It is, therefore, highly important that the railroads have a practical method of determining whether the specified capacity will be derived from cells when being purchased. A decided benefit is, therefore, bound to result from the efforts of the Committee on Chemicals to provide a new specification for caustic soda primary cells and renewals. Adherence to these requirements on the part of all manufacturers will encourage the development of the primary cell. I. S. Raymer, signal engineer of the Pittsburgh & Lake Erie, has been chairman of this committee for four years, and was chairman of Committee XVI—Oils in 1920.

I. S. Raymer
Chairman

THE committee presented for acceptance and submission to letter ballot a report on a specification for caustic soda primary cells and renewals.

Standard Voltage Caustic Soda Primary Cells

1. **Purpose.** (a) The purpose of this specification is to provide standard voltage caustic soda primary cell, using copper-oxide as the positive electrode and depolarizer and amalgamated zinc as the negative electrode in a solution of sodium hydroxide and which shall be designated by the letters A. R. A. followed by the rated capacity in ampere-hours.

2. **Material and workmanship.** (a) Material and workmanship shall be first-class in every respect.

(b) Any ingredient which will materially alter the voltage shall not be introduced into the cell.

(c) Each cell shall include the following parts: 1. Assembled unit. 2. Can of caustic soda. 3. Bottle of oil (when not otherwise provided for). 4. One hexagonal nut, two wing nuts and two washers. 5. Cover. 6. Jar.

(d) Each renewal shall include the following parts: 1. Assembled unit. 2. Can of caustic soda. 3. Bottle of oil (when not otherwise provided for).

(e) Jars shall be in accordance with A. R. A. Sig. Sec. Spec. 11321 and A. R. A. Sig. 1053B unless otherwise specified.

(f) Covers shall be as shown on A. R. A. Sig. Sec. 1053B.

(g) Washers, nuts and bolts shall be as shown on A. R. A. Sig. Sec. 1053B and/or R. S. A. 1070.

(h) Assembled unit shall consist of a positive and a negative electrode rigidly supported, insulated and equipped with connecting wires and suspension bolts.

(j) Suspension bolts shall be as shown on R. S. A. 1070 and shall extend 1⅛ in. above top of cover when unit is tightened to cover.

(k) Negative connection shall be not smaller than No. 12 A. W. G. soft-drawn insulated copper wire and of such length as to extend 12 in. through cover.

3. **Inspection.** (a) Purchaser may inspect the material at all stages of manufacture.

(b) Purchaser may inspect the completed product to determine that the requirements of this specification have been met.

(c) If the material has not been accepted at point of production and if, upon arrival at destination, it does not meet the requirements of this specification, it may be rejected, and the contractor, upon request, shall advise the purchaser what disposition is to be made of the defective material. The contractor shall pay all freight charges.

(d) If the purchaser is to make inspection at point of production, it shall be so stated.

4. **Tests.** (a) Tests may be made at point of production, or on samples submitted, and may also be made at destination.

(b) Contractor shall give the purchaser sufficient notice of time when material will be ready for testing.

(c) Contractor shall provide, at point of production, apparatus and labor for making the required test under supervision of purchaser.

(d) If tests are to be made at point of production it shall be so stated. Purchaser will distinctly indicate which of the tests herein specified are to be made and what portion of the material shall be tested.

(e) Test cells shall be selected at random by picking out not more than 10 or less than 2 cells from each lot to be furnished for the tests.

(f) A. R. A. Signal section instructions for installation and handling of caustic soda batteries shall be followed in these tests, excepting as hereinafter modified. Tests shall be made in jars in accordance with A. R. A. Sig. Sec. 1053B, detail 10532 for 500 a-h. capacity, 10535 for 1,000 a-h. capacity, and by using 4,400 c.c. of soft water for 500 a-h. and 8,000 c.c. of soft water for 1,000 a-h. cells. Assembled units must be submerged in electrolyte ¼ in. If above quantities of water will not accomplish this, units must be lowered to proper level.

(g) Temperature readings will be taken with the bulb of the thermometer resting against the outside surface of the zinc, midway of the element. Temperature shall be maintained within 2 deg. F. of the figure shown while readings are being taken. Tests may be made at higher temperature, except that while readings are taken, the temperature of the solution shall be maintained within limits specified.

(h) Meters and thermometers shall be compared with standard instruments and necessary corrections made. Readings shall be recorded with explanation of irregularities.

(j) Cells will not be on open circuit at any time during or between tests.

(k) Voltage readings shall be taken across the terminals of cell.

(l) Variable resistance shall be adjusted as may be necessary to maintain the desired discharge rate within 2 per cent.

5. **Procedure for testing.** (a) Initial polarization tests shall be in accordance with section 6.

(b) Capacity tests shall be in accordance with section ....

(c) Final polarization tests as per section 6 when 98 per cent of the rated capacity has been delivered.

(d) Polarization tests as per section 6 may be made at any time during the rated life of the cell.

6. **Polarization tests.** (a) Cells will be discharged at 68 deg. F. at 350 m.a. for 1 hr.; then discharged at 3 amp. for 30 min. during which discharge voltage shall not fall below the following values per cell at the time indicated:

1. At the end of 5 min. not less than 0.485 volt.
2. At the end of 10 min. not less than 0.480 volt.
3. At the end of 15 min. not less than 0.475 volt.
4. At the end of 20 min. not less than 0.470 volt.
5. At the end of 30 min. not less than 0.470 volt.

(b) Cells will then be discharged at 350 m.a. for 16 hr., during which time temperature will be reduced to 34 deg. F. by being surrounded by ice or other cooling means. Cells will then be discharged at 3 amp. for 30 min., during which discharge voltage per cell will not fall below the following values at the time indicated:

1. At the end of 5 min. not less than 0.290 volt.
2. At the end of 10 min. not less than 0.285 volt.
3. At the end of 15 min. not less than 0.280 volt.
4. At the end of 20 min. not less than 0.275 volt.
5. At the end of 30 min. not less than 0.270 volt.

7. **Capacity tests.** (a) Cells will be discharged in series through a measured circuit consisting of an ampere-hour meter and a fixed resistance at a temperature of 60 to 75 deg. F. until rated capacity has been delivered. The resistance of external circuit for 500 a.-h. capacity cells shall be 0.5 ohm per cell; for 1,000 a.-h. capacity cells shall be 0.25 ohm per cell. Resistance for the other capacities shall be in the same ratio. (b) Until 98 per cent of rated capacity has been delivered and while discharging through fixed resistance, voltage shall be not less than 0.56 volt per cell at 68 deg. F.

8. **Exhausted units.** (a) Exhausted units returned for credit shall be in condition substantially as they were taken from service, with such breakage as cannot be reasonably avoided in packing and handling. (b) Manufacturer may make such inspection of the exhausted units either at factory or on the railroad as will permit him to check properly the condition and number of units.

9. **Packing.** (a) Material shall be prepared to permit convenient handling and to protect against loss or damage during shipment. (b) Elements, whether for complete cells or renewals shall, unless otherwise ordered, be packed 16 in a container, including units, caustic soda and oil.

10. **Marking, and warranty,** standard sections.

Action recommended: subject-matter to be superseded—A. R. A. Signal Division Spec. 8720, "Type A" Caustic Soda Primary Cells and Renewals."

Committee: I. S. Raymer (P. & L. E.), chairman; A. B. Himes (B. & O.), vice-chairman; R. F. Annear (C. R. I. & P.), R. D. Ashley (I. C.), G. L. Baggerman (L. & N.), F. A. Beck (Penna.), C. F. Jones (Sou.), I. K. Johnson (D. L. & W.), H. L. Kilian (N. Y. C.), E. W. Kolb (B. R. & P.), H. C. Lorenzen (P. M.), S. U. Rhymer (C. & A.), D. S. Rice (L. V.), B. H. Richards (D. & H.), F. B. Smith (N. Y. C.), W. S. Storms (Erie), and A. H. Yocum (Reading).

Discussion

[Chairman I. S. Raymer, (P. & L. E.) introduced A. B. Himes (B. & O.), the Chairman of the Sub-Committee on Batteries and requested him to make the report.]

Mr. Himes: The committee desires to make changes in the specifications. Following 5 (c) insert a note. "Should it be apparent that 98 per cent of rated capacity will be delivered at an hour inconvenient for conducting the final polarization tests, it will be satisfactory to increase the resistance in series by not more than two ohms so as to defer tests for a few hours providing the normal resistance has been restored for not less than four hours before the 98 per cent discharge point has been reached."

J. S. Gensheimer, (Penna.): I have made some tests in accordance with these specifications and find that the initial polarization test as given here is of no value. We were unable to find any cell that would not meet the initial polarization test. The test as outlined for the final polarization test is not bad. But as an initial test, it is really worthless, and the tests as a whole are rather cumbersome; they take considerable time and much work, but disregarding this the specification should be strengthened in the initial polarization test. The tests we have made indicate that during the initial polarization test the voltage should not fall below 0.56 of a volt; in other words, about the same point as has been used for the capacity test in this specification. I see no reason for making polarization tests except the initial and the final ones. 5. (b) permits polarization tests to be made at any time during the life of the cell, and I would suggest that this feature be eliminated.

Mr. Himes: The committee is not willing to accept the suggestion because to do so is to make the specification require a cell voltage which will of necessity limit development. The initial polarization test is not worth much, because the cells on the market today will meet it. It is possible to put out a cell which could meet the remainder of the specification and not meet the initial polarization test.

R. B. Ellsworth (N. Y. C.): The committee has been working for 15 years on this specification. Before asking them to change it we should give some reason for doing so.

M. L. Martus (Waterbury Battery Co.): We have made some tests regarding polarization. As proposed the specification does not uphold the high standard of the present specification. It is shown by the polarization test, especially if it is carried lower than 33 deg. At the end of 30 min. eight different cells recorded .581 volt at 68 deg. At 33 deg., the lowest figure at the end of 30 min. was .512 volts. At 20 deg. cells which passed the present specifications read from .588 to .578, whereas the cells which will not meet the present specification read as low as .482, showing that the specifications as proposed will admit a battery of much lower standard.

Mr. Himes: The committee does not expect the initial polarization tests to weed out the defective cells unless that defect is initial high internal resistance.

Mr. Gensheimer: I can not conceive an ideal cell with a capacity test voltage of 0.56 of a volt only being 0.27 of a volt. You can, if you make it a few degrees cooler.

Mr. Himes: The committee feels that the figures as given under polarization tests 6 (a) and (b) are satisfactory to operate the functions after the cell has delivered 98 per cent of its rated capacity.

Mr. Gensheimer: That does not agree with the tests we made. On one cell the voltage was too low under the temperature conditions to give satisfactory operation.

Mr. Himes: Cells that would not meet this test, immediately on being set up have been sold to railroads.

Mr. Gensheimer: Strengthening the test would not let those batteries in, would it?

Mr. Himes: We have.

Mr. Gensheimer: I do not agree with you.

W. M. Post (Penna.): We would not use this specification because in our opinion it would let in some cells that would not give us the service required.

H. G. Morgan (I. C.): On the basis of 16 cells of our present established batteries, 17 or 18 will be required to perform the same service.

Mr. Himes: We are depending upon the initial polarization test, capacity test and final polarization test, combined, and this will weed out the bad cells.

Mr. Gensheimer: One cell was very poor on the initial polarization test, but met all of the other tests, better than batteries which are giving much better service.

L. S. Dunham (Thos. A. Edison, Inc.): While it is true that a cell should perform as well in the beginning

as at the end or vice versa, in actual practice some local conditions will necessitate heavy current or low temperature. While it is theoretically true that there is no particular reason for having an initial voltage higher than the voltage after the expiration of 100 per cent of rated capacity, in actual practice it does give a lot of relief to be able to get a little extra pep when you put in the new one.

Mr. Himes: The Committee recommends acceptance for submission to letter ballot superseding the present subject matter in the Manual.

[Motion lost by vote of 71 to 56.]

Report of Committee I—Economics of Signaling

The work of the committee included a study of the economic features of the several phases of signaling. The report included detailed calculations of the savings produced from a signaling standpoint by 39-ft. rails, and a discussion of the economy of gas-welded rail bonds for signal track circuits, stating actual costs and explaining the benefits. The report also describes the installation of wig-wag and flashing light highway crossing signals, explaining the costs and savings produced by several unique installations, one of which cost $31,500 and saved $10,000 a year in wages alone. Changes in protection at 25 crossings in one town saved $9,213 a year. B. T. Anderson, superintendent of signals of the Chesapeake & Ohio, has been chairman of this committe since 1921.

B. T. Anderson
Chairman

THE committee submitted for acceptance as information reports on the following subjects: 1. Economy of 39-ft. rail; 2. Economy of gas-welded bonding; 3. Economy of replacing highway crossing gates with wig-wags on the C. & N. W. at Elgin, Ill.; 4. Economy of substituting flashing light signals for watchmen on the Pennsylvania at Kokomo, Ind., and 5. Progress report.

Economy of Thirty-nine-Foot Rail

The use of 39-ft. rail in place of 33-ft., has made an improvement in signal operation due to the effect this change has on the return circuit itself. These improvements or advantages may be grouped under several headings as follows:

Investment. In bond renewals on new rail; there will be 15 per cent less bonds required to cover the same signal mileage on new rail programs in existing signal locations.

Maintenance. There will be 15 per cent fewer bonds, resulting in a proportionate lowering of expense in maintaining bonding to the same standard of perfection.

Operation. There will be 15 per cent fewer bonds, resulting in operating improvement or reduction in number of train stops due to signal interruptions caused by broken bond wires. This makes for both an increase in safety and a reduction in operating expenses.

Economy of Gas-Weld Bonding

Many are the economies secured in signal track circuit maintenance and operation as a result of reduced bonded rail resistance, particularly when of such a low and uniform value as is secured with gas-weld signal bonds. Every phase of track circuit operation is affected from the economic and reliability standpoint by such reduction.

A No. 2 A. W. G. 7 in. gas-weld bond has an installed resistance of 0.000,100 ohm. One hundred pound rail so bonded will show a resistance value of about 0.025 ohm per 1,000 ft. of track.

Where a careful study of results secured with gas-weld bonds, as compared with No. 8 iron wire bonding has been made, actual annual money savings for battery material only have been effected as high as $56 per block on 7,000-ft. block sections due principally to the elimination of cut sections and changing of battery connections from multiple-series to multiple.

Insertion of a maximum amount of external resistance is made possible by the uniform unvarying resistance secured by bonds of sufficient capacity to carry all of the current independent of joint plate contact.

The table following gives an idea of the economic value of gas-weld bonds on a few track circuits from the material cost standpoint only; these figures being taken from actual records. No estimate is made of the savings achieved by reduced maintenance time.

Material Savings on Primary Battery Track Circuits Resulting From the Installation of Gas-Weld Bonds

Length of circuit, ft.	Kind of bonds	Total number cells connected	How connected	Average life in days	Number cells installed per year	Actual cost of cells per year	Annual savings in material only with use of gas-weld bonds
5016	Iron-channel pin	8	M S	82	35.2	$28.16	
	Gas-weld	5	M	245	7.5	6.00	$22.16
3300	Iron-channel pin	8	M S	75	38.4	30.72	
	Gas-weld	5	M	200	9.	7.20	23.52
6996	Iron-channel pin	8	M S	66	44.	35.20	
	Gas-weld	4	M	159	9.2	7.36	27.84
7392	Iron-channel pin	8	M S	65	44.8	35.84	
	Gas-weld	5	M	166	11.	8.80	27.04
6000	Iron-channel pin	4	M	79	18.4	23.00	
	Gas-weld	5	M	215	8.5	10.63	12.37
6900	Iron-channel pin	4	M S	90	16.	20.00	
	Gas-weld	4	M	254	5.6	7.00	13.00
7000	Iron-channel pin	4	M S	50	29.2	36.50	
	Gas-weld	4	M	190	5.6	7.00	29.50
6900	Iron-channel pin	4	M S	72	20.	25.00	
	Gas-weld	5	M	229	5.5	6.88	18.13

As shown in the table herewith substantial savings in track circuit operation can be secured by a reduction of the bonded rail resistance. These sav-

ings are appreciable, and in many instances, will pay an attractive return on the entire bonding investment.

In one instance low resistance welded bonds were installed on 9 automatic block sections which had previously been cut into 19 track circuits. With the completion of the new bonding 10 cut sections were eliminated so that in each case the track circuit extended the length of the automatic block. Accurate records of battery renewals were kept prior and subsequent to the installation of these bonds, and records show an annual saving in battery renewals of 44.77 per track mile, or a total of 434.23 on 9.7 miles.

Cut section material removed had a salvage value of $909. The bonding in place cost $1,331.62. Subtracting the salvage value of $909, the bonds on this 9.7 miles showed a net cost of $422.62, on which a saving of $434.23 was shown the first year, over 100 per cent on the investment, to say nothing of the betterment in performance and reduced labor of maintenance. In another instance on four track circuits where no cut sections existed, the circuits extending from signal to signal, 26,800 ft. of track was bonded with low resistance bonds at a cost of $589.45. As a result the actual annual battery saving in battery renewals alone was $72.99, or 12.4 per cent on the investment.

Costs, of course, vary and are dependent upon numerous factors such as time consumed in moving and handling materials, the manner in which this work is done, time lost waiting for steel to be laid, especially at switches, but a figure of 43 cents per joint for bonding in place is considered by one large user as typical of average costs. A recent installation of 20,000 bonds on 60 miles of rail was made at a cost of 37 cents per joint. This was on old rail and no time was lost account following a rail gang.

Signal interruptions due to broken bonds have been materially reduced where the gas-weld bond has replaced iron bond wires, and except for those interruptions caused by derailments, dragging equipment or improperly made welds, they can be considered as practically eliminated.

An increase in the safety factor of signal operation due to a bonded rail resistance of approximately 0.025 ohm per 1,000 ft. of track makes itself manifest in improved train shunting characteristics and broken rail protection both from the standpoint of reduced current flow through relay with rail removed or broken, and decreased distance spanned by the bond.

Welded bonds can generally be more economically installed than channel pin bonds in paved street, road crossings, station platforms and on bridges where guard rails are used. The foregoing relates particularly to the economies of welded bonds as applied to existing signal installations. Economies may be effected on new construction due to the longer track circuits that may be operated with gas-weld bonds with the same relative degree of safety as is now obtained on much shorter circuits channel pin bonded.

In making a comparison of the relative safety of signal track circuits, it is necessary that safety standards be established. The main ones would appear to be train shunt and broken rail protection. It then becomes a matter of deciding upon some minimum resistance of train shunt, and also maximum allowable current flow through relay with rail removed or broken. Then determine the maximum lengths of circuits that can be operated with different bonded rail resistances maintaining these standards of safety.

The committee recommended that this matter be made the subject for study during the coming year with the idea of determining what economies can be effected in new construction by taking advantage of such information.

Economy of Replacing Highway Crossing Gates with Wig-Wags on the C. & N. W. at Elgin, Ill.*

The Chicago & North Western has recently completed an extensive installation of 41 wig-wags in the city of Elgin, Ill., as protection for highway traffic at 25 street crossings, there being two wig-wags at 16 crossings and one at each of the remaining nine crossings. These wig-wags replace gates or flagmen at most of the crossings and have thus made possible a saving of $9,213 a year.

Economy of Substituting Flashing Light Signals for Watchmen on Pennsylvania at Kokomo, Ind.†

The Pennsylvania has installed 31 standard flashing color-light signals at 13 grade crossings on 15 streets in Kokomo, Ind. These signals replaced 10 crossing watchmen located at 10 crossings, each being on duty 12 hrs. a day. The total cost of the installation was approximately $31,500. The saving in wages of the watchmen amounted to approximately $10,000 a year.

Progress Report

Since the 1926 stated meeting, one committee and several sub-committee meetings have been held with large attendance and very interesting discussions.

The progress on special assignments is as follows:

(a) Chapter on "Economics of Railway Signaling" is under way.

(b) Car retarders. Recent installations are being watched and a progress report will be presented as information becomes available.

(c) Economy of train operation following a divisional installation of automatic signals. This work is being handled in conjunction with the officers of the railroad. An interesting report is expected on this assignment.

(d) Spring switches and automatic interlocking plants. These assignments are being handled in conjunction with Committee III.

(e) Forms for determining economic value of signaling. The committee has under discussion two forms, one for interlocking plants and another for automatic signal installations. It is hoped to have these forms in shape for presentation at the 1927 stated meeting.

(f) Savings effected by remotely-controlled switches. The committee has sent out a questionnaire on this subject and will later be able to bring the subject-matter on this subject now in the proceedings up-to-date.

(g) Savings effected by substituting crossing protection devices for crossing gates and watchmen. The committee is working on this assignment and hopes to have a report at some future meeting. The committee will welcome reports and inquiries relative to economics of railway signaling.

Committee: B. T. Anderson (C. & O.), chairman; G. S. Pflasterer (N. C. & St. L.), vice-chairman; E. B. DeMeritt (C. of G.), W. J. Eck (Sou.), W. F. Follett (N. Y. N. H. & H.), R. B. Jones (C. P.), W. M. Post (Penna.), J. E. Saunders (D. L. & W.), R. T. Scholes (C. B. & Q.), B. J. Schwendt (N. Y. C.), and W. S. Storms (Erie).

Discussion

Chairman B. T. Anderson (C. & O.): This report is submitted as information only.

*Abstract of report in *Railway Age* of November 27, 1926.
†Abstract of report in Railway Signaling, June, 1926.

J. A. Peabody (C. & N. W.): In the last line it says, "and have thus made possible a saving of $9,213 a year," That should be "a net saving of $9,213 a year," because our saving for flagmen and gatemen's wages was $1,232. Then after allowing for the cost of maintaining the wig-wags, interest and depreciation on the investment, we get this amount of $9,213.

Mr. Anderson: The committee is preparing forms for determining the economic value of signals, one for interlocking plants and another for automatic signals. The committee sent out a questionnaire on remote power switches to be submitted at the next meeting. The committee also has under way a revision of the subject matter now in the literature on the saving effected by substituting crossing protection devices for crossing gates and watchmen.

C. A. Christofferson (N. P.): The Northern Pacific is now installing, in Tacoma, Wash., wig-wags that will cost $16,000, and will save more than $10,000 a year.

C. J. Kelloway (A. C. L.): We are installing, in Orlando, Fla., light signals at 21 crossings.

C. A. Mitchell (N. Y., N. H. & H.): If we show city authorities that other states and other cities approve the up to date devices rather than the crossing flagmen, it should be of considerable help.

Report of Committee X—Signaling Practice

In order to eliminate confusion on the part of enginemen between signal indications, especially when running at high speeds, it is becoming more and more essential that the number of indications be reduced and that similarity between different aspects be eliminated as far as possible. It is desirable that the engineman and fireman communicate to each other by its name, the indication of all signals.

F. B. Wiegand
Chairman

The committee has, therefore, given considerable study to this problem and presented a progressive report. Among the noteworthy advancements in the art of signaling the committee considered that car retarders and cab signals superseding wayside signals the most important. F. B. Wiegand, signal engineer, New York Central, Lines West, has been chairman of this committee for the last four years.

THE following outline of work had been assigned to this committee: 1. Revision of Manual; 2. Automatic train control; 3. Investigate light signal aspects and submit report on recommended display of light signal indications and aspects; 4. The effect on track capacity by shortening the length of blocks in automatic territory, using indication 501-E as given in the standard code; 5. Report on noteworthy advances in signaling practice; 6. Investigate and recommend the utility and desirability of safety devices other than automatic train control.

The caption, "Use of Derails," is a misnomer, the recommended practice is the non-use of and not the use of derails. The caption should be revised. A report on this subject-matter was submitted at the 1926 stated meeting and there approved for presentation at the annual meeting.

Under the assignment on automatic train control, the committee reported progress. It is keeping in touch with the situation and will investigate any new development and after such investigation is concluded will submit a report.

Under Assignment 3, the committee submitted a report eliminating the multiplicity of signal aspects as shown on pages 42 to 55, inclusive, of the 1926 stated meeting advance notice. It was the opinion of the committee that instead of showing the color-light, the position-light, the color-position-light and other schemes and designs of aspects submitted to the committee, a more harmonious method of showing these would be by rule number, name and indication and inserting the note "each road should show the aspect and color of light it uses." This method at least establishes uniformity in name and indication. Attention is called to the elimination of the word "signal" at the end of the name. The name applies to the indication and not to the signal; the code rule governing reads as follows: "The engineman and fireman must, when practicable, communicate to each other *by its name the indication of all signals* affecting the movement of their train."

Under Assignment 4, the committee referred the members to its report appearing on pages 56 to 60, inclusive, of the 1926 stated meeting advance notice, and which was accepted as information at that meeting. Under Assignment 5, the committee submitted what it considered an advancement in the art. Under Assignment 6, the committee reported progress.

Use of Derails

The committee recommended the title "Use of Derails," part 56 of the manual, be changed to read "Derails" asking that it be accepted for submission to letter ballot superseding subject-matter in the manual.

Signal Aspects, Signal Indications and Names of Indications

The committee's recommendation was shown on pages 574 to 578, inclusive, in the advance notice and it asked for acceptance for submission to letter ballot superseding "Signaling Practice," part 143 of the manual.

Noteworthy Advances in Signaling Practice

The following were considered by the committee as advancements in the art of signaling: 1. Car re-

tarders; 2. Cab signals superseding wayside signals. This was recommended for acceptance as information.

Committee: F. B. Wiegand (N. Y. C.), chairman; B. T. Anderson (C. & O.), vice-chairman; W. E. Boland (S. P.), W. J. Eck (Sou.), W. H. Elliott (N. Y. C.), G. E. Ellis (A. R. A.), J. V. Hanna (K. C. T.), J. C. Mock (M. C.), H. G. Morgan (I. C.), F. P. Patenall (B. & O.), J. A. Peabody (C. & N. W.), F. W. Pfleging (U. P.), W. M. Post (Penna.), A. H. Rudd (Penna.), T. S. Stevens (A. T. & S. F.), E. G. Stradling (C. I. & L.), W. M. Vandersluis (I. C.), and R. C. White (M. P.).

Discussion

Chairman F. B. Wiegand (N. Y. C.): The committee recommends the title "Use of Derails," in the Manual be changed to read "Derails." The action recommended is acceptance for submission to letter ballot to supersede the subject matter now in the Manual. [*Motion was carried.*]

Chairman Wiegand: With reference to the report on Signal Aspects, Signal Indications and Names of Indications, the aspects submitted probably will eliminate figures 34, 35 and 36, which were submitted by Committee V yesterday. These eliminate the multiplicity of aspects. The committee withdraws its recommendation and is submitting this matter as information only.

Committee X was asked to co-operate with the Rules committee of the operating division. Originally we submitted the aspects shown. These were not acceptable to the Rules committee, so Committee X gave the matter further consideration and submitted what we have here. They have adopted a definition for "restricted speed" reading as follows: "Proceed, prepared to stop short of trains, obstructions or anything that may require the speed of the train to be reduced." This, in the opinion of Committee X is the definition of slow speed.

Mr. Rudd: The Rules committee has insisted on putting in a definition of restricted speed, which means that the present restricted speed which most of us use, 30 miles an hour, is eliminated. Committee X is on record as opposed to the definition for restricted speed. *I move that it is the sense of this meeting that the substitution of the words "restricted speed" for "caution" in the code is wrong.*

Mr. Stevens: A vote on the floor here does not indicate the railroads' attitude.

Chairman McKeen: I think you are right and Mr. Rudd's motion is overruled.

Report of Committee VIII—A-C. Automatic Block Signaling

The increasing use of a-c. power for signal and train control operation, whether directly or indirectly through the use of the a-c. floating battery system, broadened the scope of this committee's work and extended its usefulness from year to year. In its report the committee submitted as information its recommendations for distributing a-c. power in connection with the use of rectifiers for the a-c. floating system. A co-operative report dealing with the subject of inductive interference was also included. A distinctly educational feature of the committee's work was the inclusion of a report of the extensive investigation of lightning protection conducted by the Pennsylvania last summer. C. H. Morrison, signal engineer, New Haven, has been chairman of this committee for 13 years.

C. H. Morrison
Chairman

THE committee submitted for consideration, reports on the following subjects: 1. Revision of Manual; 2. Report on rectifiers for signal systems; 3. Report on alternating current circuits and apparatus as applied to train control; 4. Report on inductive interference of alternating current circuits and supply lines for signals and train control with communication circuits, conferring with Committee No. 7, T. & T. section; 5. Report on protection from lightning and a co-operative report—American Committee on Inductive Co-ordination. The committee reported progress on assignments 1, and 3 and also on the co-operative work.

Rectifiers for Signal Systems

This report pertained principally to field requirements where all power for the operation of signals and their controlling direct current apparatus is obtained from alternating current power lines, the system being generally known as the "a-c. floating battery system."

Battery charging transmission lines.—When power wires carry in excess of 550 volts, also when carrying not to exceed 550 volts, but in excess of 1,600 watts are placed on poles which also carry communication or other low-voltage wires, they should occupy the upper cross-arm and have a vertical spacing of not less than 48 in. between the power and communication, or other low-voltage wires. Power wires carrying not to exceed 550 volts and not in excess of 1,600 watts, may when placed on poles which also carry communication wires, occupy the lower cross-arm as required by Specification 220B of the National Electrical Safety Code.

Supply transformers.—A transformer of required capacity fused on both the primary and secondary sides should be installed between the supply line and the battery charging transmission line, as required by the National Electrical Safety Code.

Local power transformers.—When desired for insulating purposes, a transformer may be used between the transmission line and the rectifier transformer. The primary coil to have insulation to withstand 10,000 volts between it and the secondary winding, core or case. Such transformers should be provided with taps to compensate for line drop.

Rectifier transformers.—The recomended voltage taps on the primary side of rectifier transformers are as follows:

Nominal circuit voltage	Full winding	Compensating taps
110	115	100
220	230	200
440	460	400

Secondary windings.—If rectifier transformers are desired for operating more than one rectifier there shall be a separate adjustable secondary winding of required capacity for each rectifier. The following combinations are recmended: 1. Transformer having two secondary windings to charge two independent track batteries; 2. Transformer having four secondary windings to charge two independent track batteries, and one line battery; also one adjustable secondary for the operation of signal lamps and power-off relay.

Lightning protection.—Line transformers should be protected by lightning arresters of low breakdown and large rupturing capacity, connected as closely as practicable to the primary winding of the transformer. Particular attention should be paid to obtaining a low resistance ground (not to exceed 15 ohms) and the ground lead to lightning arrester not smaller than No. 6 A. W. G. Ground connection for the protection of power apparatus should not be used in common with that of higher or lower voltage apparatus. Cutouts should be introduced between line and each primary lead of the line transformer to provide means of manually disconnecting a transformer. When desirable fuse cutouts may be used to automatically disconnect from the line a transformer that has broken down and introduced a short circuit across the line, thus insuring continued service at unaffected localities.

Regulation.—Regulation of charging output of a rectifier may be obtained by means of an adjustable resistor or reactor in the secondary side, by suitable voltage taps in the secondary winding, or by reactive transformers, as desired. Care should be taken that the means of regulation used does not allow excessive variation of charging rate with commercial variation of supply voltage.

Power transfer relay.—A relay known as a power transfer (power-off) relay may be used to shift the load from the line to a standby battery, and where used should have two front and two back non-independent contacts of low resistance material to carry 250 watts at not to exceed 15 volts d.c.

Action recommended: acceptance as information.

Inductive Interference of A-C. Signal Power Lines With Communication Circuits

There have been no joint meetings with Committee No. 7 of the T. & T. section, or Committee No. 4 of the T. & T. section, since the report to the Signal section at the 1926 annual meeting. However, Committee No. 4 submitted a paragraph to be used as a note under paragraph A-2 of their specification for electrical protection of the railroad T. & T. plant (4-2) which is as follows:

"Protection herein specified, if properly installed and maintained, will protect the communication plant against voltages up to 2,900 volts to ground in practically all cases. The measure of protection that will be obtained in the event of contact between the communication wires and supply circuits of higher voltage will depend upon conditions which in the particular case may limit the voltage at the fuse terminal and the short circuit current that will flow as a result of the contact. Attention is called to the fact that under certain conditions a three-phase delta or any other system with ungrounded neutral may have a potential to ground as high as the potential between conductors."

It is understood by the foregoing that the matter of grounding the center of the secondary coil of the service transformer has been abandoned and the foregoing paragraph used to call attention to the limitations of the protective device specified under paragraph A-2 of the specification for electrical protection of the railroad T. & T. plant.

At the annual meeting of the T. & T. section last September, Committee No. 7 recommended a list of precautionary measures for situations where joint use of the lines may be necessary, known as Exhibit D, as follows:

Exhibit D—Precautionary Measures Recommended in Situations Where Joint Use May Be Necessary

General.—A-1. Joint use with the higher voltage circuits of Class P-2 as defined in the Specification for the Joint Use of Poles for Power, Communication and Signal Circuits, should be restricted to situations in which the occupancy of individual lines adequately separated is impracticable. A-2. To mitigate possible inductive interference, it is recommended that the following precautionary measures be complied with as far as practicable.

Transpositions.—B-1. Carefully co-ordinated transpositions in the supply and communication system should be installed. (See Specifications for Locating and Installing Transpositions in Telephone Circuits 1-D-1). B-2. Where communication circuits are numerous, particularly where phantom circuits are employed, the amount of transposing of the supply circuits may often be profitably increased.

Maintenance.—C-1. High grade maintenance of all circuits concerned in the exposure and the prompt clearing of troubles are important.

C-2. An accidental ground on a supply system normally ungrounded may cause severe noise conditions until the fault is removed. Such faults should, therefore, be cleared with the least possible delay.

Wave shape.—D-1. The wave shapes of generating machinery should be as nearly sinusoidal as practicable. This is particularly important for the higher train control frequencies.

Transformers.—E-1. Transformers should be operated at low magnetic densities. Where connection to ground is required for protective or other reasons, such connection should be limited, if possible, to a single point. Where the power capacity of the systems makes it desirable, means of minimizing short circuit current and their duration at times of faults should be provided.

E-2. Transformers connecting a three-phase source of supply to the railway power line should be delta connected on the power station side. Transformer banks supplying loads from the railway power line should be delta connected on at least one side. Loads should be balanced with respect to phases.

E-3. Provision should be made to isolate foreign sources of power, or sources of power used for other purposes, from the signal supply systems.

It is understood that Committees No. 4 and No. 7 of the T. & T. Section intend to have a final meeting or further joint meetings with this committee.

Action recommended: acceptance as information.

Report on Protection from Lightning

The committee presented as information a report of the klydonongraph investigation conducted by the Pennsylvania during the past summer, together with certain deductions and observations. The object of this test was to determine the effect of lightning on various circuits used in a modern block signal system. The circuits investigated were a 3,300-volt overhead power line; two 3,300-volt underground power cables; one 220-volt power line; one 55-volt control line and one 6-volt track circuit and track relay. The information was desired to enable a more intelligent application of protective equipment.

Description of instruments used.—The klydonograph, developed by J. F. Peters, consulting engineer of the Westinghouse Electric & Manufacturing Company is a graphic voltmeter having a time lag of about 10 sec. With such an instrument any over-voltage surge, however rapid, may be recorded if the magnitude is within its range. It consists of a contact on a photographic plate of film which is in turn in contact with a grounded metal plate. When a voltage is impressed on the contact an electro-static field builds up around it. This field makes an impression on the photographic emulsion which shows, when developed, a round figure made up of radial lines. The size of this figure is a measure of the voltage producing it. The appearance indicates the polarity and approximate wave front of the surge. The contact is driven at a constant speed by a clock, thus giving the time element and making the instrument graphic. The range of the klydonograph is from 2,000 to 18,000 volts. For higher voltages the instrument is connected to the line through an electro-static potentiometer. There is no way to measure voltages below 2,000 with the klydonograph.

Conclusions and Observations

Lightning surges on the 3,300-volt power lines reach very high voltages and are responsible for apparatus failures. The voltage to which induced surges can rise is lim-

ited by the insulaton flashover of the line. This is shown by the great difference in the voltages recorded on the 3,300-volt line and the 55-volt line during the same lightning stroke. A suitable arrester on the 3,300-volt line would have an effect similar to the low insulation on the 55-volt circuit. Lightning at times causes surges in the track circuits of sufficient value to break down track and relay coil insulation. The highest recorded was 3.5 k.v.

The records obtained, as far as the overhead lines and track circuits are concerned, are about as expected. The figures show that generally speaking the amount of transient voltage which may be impressed varies as the line insulation varies. The higher voltage lines being of necessity better insulated than those of lower voltage will be subjected to very high voltages which may damage any connected apparatus or will flash over or puncture the line insulation. The surge voltage which may be impressed on the lower voltage lines will probably not be so high before it is dissipated through the low line insulation but may be high enough to do considerable damage to delicate connected instruments.

The obvious and easiest remedy for either high or low-voltage circuits is to provide lightning arresters which will relieve the line before dangerous voltages can be established. It may be economical for the ordinary commercial line to limit the number of arresters, as in such cases the cost of installing and operating an arrester may exceed the revenue that would be lost during the time of interruptions, but for signal lines where continuity of service is so desirable and necessary, the best arrester should be obtained and enough used to accomplish the desired result.

There was evidence enough in the klydonograph records of the 3,300-volt underground line, however, to enable making certain deductions and drawing more or less definite conclusions as regards an unshielded underground line, either for power or control circuits, the most important of which is that apparently under certain conditions such a line assumes the characteristics of an overhead line and is subject to the same induced potential from a charged cloud.

Many of the breakdowns occurred where the line is located on a bank considerably above the track level and many of those occurring where the line was at track level were in location where a good ground was hard to obtain. In other words, there is, in all probability, a voltage gradient existing between the surface of the ground and points considerably below it at very many locations. The breakdowns appear to be due to a high voltage surge electro-statically impressed on the unshielded underground line in the same manner as on an overhead line, but instead of flashing over at an insulator there is a thin static discharge of very little current which punctures the insulation and the breakdown occurs instantly or, as usually happens, some time afterward, when the line leakage becomes considerable.

The fact that breakdowns due to lightning rarely occur where the line is located between tracks is further evidence that there is a certain amount of shielding afforded by the rails, which reduces materially the static charge on the underground conductors.

Finally, if the deductions drawn herein are correct, that unshielded underground lines assume the characteristics of aerial lines under certain conditions, lightning protection should be provided in much the same manner, or metallic sheath cables be installed. The principal difference between underground and aerial lines is that, in the case of the first mentioned, arresters are used to protect the line insulation and, in the second, they are used, for the most part, to protect connected apparatus. Apparatus, such as transformers, switches, etc., are rarely damaged when connected to an underground line, but are frequently damaged when connected to an aerial line.

Because, in an underground line, protection to insulation is of the first importance, lightning arresters should be distributed rather closely so that induced voltages which may be more or less local may be drained off before the line insulation is punctured. In an aerial line, arresters are sometimes installed between apparatus locations, but for the most part the arresters are placed only at locations, for the reason that high potentials will usually dissipate over the insulators, especially if it is raining.

The committee was of the opinion that long unshielded underground lines should be studied from much the same angle as overhead lines and the maximum amount of lightning protection should be afforded.

Committee VIII: C. H. Morrison (N. Y. N. H. & H.), chairman, L. F. Vieillard (L. I.), vice-chairman, T. N. Charles (Sou.), J. H. Deming (C. of G.), G. H. Dryden (B. & O.), W. F. Follett (N. Y. N. H. & H.), E. N. Fox (B. & M.), C. E. Goings (Penna.), J. J. Larkin (S. B. R.), W. K. Saunders (R. F. & P.), F. E. Wass (G. C. T.)

Discussion

Sub-Chairman G. H. Dryden (B. & O.): It is only within the past two or three years that we have been permitted to place wires of these voltages on the lower cross-arms of poles carrying communication wires, as outlined in the report on the use of rectifiers. The report corresponds with what the Western Union Telegraph Company is now permitting us to do. The new code, as drawn, is in harmony with this report. The Code, however, has not been finally approved.

T. S. Stevens (A. T. & S. F.): We are now building a combination line, 4,400 volts, on the top, with the Postal circuits below and our control circuits below theirs. This is in harmony with the old code specifications. Whenever the voltage is greater than 550 or more than 1,600 watts, it is necessary to place the wires on the upper cross arm, providing a 48 in. clearance. Wires carrying less than 550 volts and not to exceed 1,600 watts may be placed on the lower cross arms.

W. F. Zane (C. B. & Q.): We have had considerable experience with 220-volt circuits, on the lower cross arms. We found at first that when we placed a power wire on each end of the arm we had considerable trouble with our dispatching circuit. Then we placed them all on one end of that arm and transposed at every mile post which helped conditions considerably, but we still had some trouble. Now we are placing both on one end of the arm, preferably the track side without transposition, and no trouble is reported.

Mr. Dryden: In order to conform to the Western Union specifications and also to the Code, the two wires must be placed on the outer end of the cross arm and on adjacent pins.

W. M. Post (Penna.): It is a matter of interest that since we have permission to place 440-volt lines on the bottom arm, the Pennsylvania has made extensive installation of that kind, in some cases 220-volt and in other cases 440-volt, which resulted in a very considerable economy in the operation of our signals.

J. J. Corcoran (N. Y. C.): Regarding lightning protection, the requirement is for a ground resistance of not to exceed 15 ohms. The present A. R. A. signal ground has a maximum of 25 ohms and in some cases it is very difficult to obtain even this resistance and to meet this requirement would be very expensive.

Mr. Dryden: This was a committee requirement, that wherever practicable the ground resistance should not exceed 15 ohms. The committee was unanimous in this recommendation.

C. F. Stoltz (C. C. C. & St. L.): I would caution the users of a fuse in the primary to take care that it is low enough to be of any value. Where the step-down is from 6,600 to 550 or 110 volts and the capacity of the line does not exceed 1,600 watts, it requires a very small fuse to be of any value in the circuit. However, under certain circumstances, it will save a transformer.

Mr. Dryden: Referring to report on lightning protection, I believe this is the first time that the committee has any record of extensive tests on lightning protection that have been made on signal wires. The use of the klydonograph is something new.

E. Beck (Westinghouse Elec. & Mfg. Co.): The information which is presented in this report was gath-

ered by means of the klydonograph, a graphic voltmeter developed by J. F. Peters of the Westinghouse Company.

Now when an impulse voltage is impressed on this small electrode, it forms what is called a Lichtenburg figure. They are of the nature of circles and their diameter is proportional to the voltage registered, and by measuring this diameter, the voltage appearing on the line will be determined. The investigation conducted by the Pennsylvania last summer was extensive. The highest voltages were on the 3,300-volt overhead line, and they went up above 40,000 volts on several occasions, and many surges of less intensity were registered.

The track circuits are close to the ground and you might expect there would be no hazardous voltages induced in them, but on several occasions the klydonographs connected to the rails registered voltages of several thousand. I think the maximum voltage was 3,500 volts. Another interesting thing found in this investigation was that the voltages on the 15-volt line were all very much lower than those found on the 3,300 volt line, although these were strung on the same poles.

Report of Special Committee on Highway Crossing Protection

In an effort to promote the standardization of aspects for automatic highway crossing signals throughout the country, the committee submitted standard layouts for flashing-light and for wig-wag signals. Approval was given to the State Highway Lighting Movement, providing precautions are taken to insure that there will be no interference with railroad operation and that plans for such installations are submitted to the committee for approval. The committee also recommended that a leaflet illustrating approved highway crossing signals be placed in the hands of state officials for delivery with each automobile driver's license at the beginning of each year. A. H. Rudd, chief signal engineer, Pennsylvania, has been chairman of this committee since 1923.

A. H. Rudd
Chairman

THE committee submitted for consideration reports on the following subjects: 1. Development of highway crossing protection, including resolutions previously submitted at annual and stated meetings. 2. Report on federal and state activities, and a report on code on colors for traffic signals.

Explanatory. In the interest of uniformity, the committee recommended that members of the Signal section oppose as far as possible any suggestions of modification of or divergence from the A.R.A. recommended practice.

Location of Highway Crossing Signal

At the 1926 stated meeting, A.R.A. Sig. Sec. 1546A was approved for presentation at the annual meeting. During the discussions, questions were raised as to foundations and whether the drawing was intended to represent a signal located in the center of the highway or at the side. Although this was approved for presentation at the annual meeting, the committee has taken the liberty of changing the word "surface of highway" on the base line to "level of highway," it being understood that this signal may be used at the side of the highway as shown, or that it may be mounted on a suitable protecting island in the center of the highway.

As different states require different shapes, sizes and painting of such islands, it is not at present possible to establish a recommended standard for such island.

Action recommended: acceptance for submission to letter ballot.

Proper Height of Highway Crossing Signal

The committee was not a unit on the recommendations, and provided for two heights of post, requesting instructions at the 1926 stated meeting. No definite action was taken. The drawing was not approved for presentation at the annual meeting nor was it referred back to the committee. While a number of the speakers taking part in the meeting advocated that the center of the wig-wag be 6 ft. above the highway, others desired 14 ft. or more; some desired short brackets and some long ones.

During the discussions questions were raised as to foundations and whether the drawing was intended to represent a signal located in the center of the highway or at the side. The committee has, therefore, revised the drawing by substituting for "surface of highway," "level of highway," and by eliminating the maximum and minimum dimensions; it being understood that this signal may be used at the side of the highway as shown, or that it may be mounted on a suitable protecting island in the center of the highway.

As different states require different shapes, sizes and painting of such islands, it is not at present possible to establish a recommended standard for such island.

The committee believes that the drawing as prepared, with these changes, is as near as we can approximate standardization at the present time.

Action recommended: acceptance for submission to letter ballot.

Under assignment (1) the committee presented as another development on highway crossing protection a statement by J. A. Peabody, member of the committee, at the 1926 stated meeting, which would apply to flashing lights as well as wig-wags:

"We have run up against difficulty in towns where objection was raised to the wig-wags because they operated when switching was going on. We have now installed several where we have what we call supervision eight or ten hours of the day, that is during the switching hours. We put in a three-throw switch. In one position the signals work automatically; the second position the man can stop the signals at any time, and in third, he can start them at any time. That has taken care of some very bad places and at the same time has not only allowed us to take off two men, but one man can supervise the signals at three or four crossings, so we have one man eight or ten hours doing the duty of three, six and nine men—an immense economy."

Action recommended: acceptance as information.

Resolutions Previously Presented at Annual or Stated Meetings

At the 1926 stated meeting the following resolutions were approved for presentation at the annual meeting:

"Resolved: Signals of the flashing light type and of the wig-wag type are standard highway crossing signals; either one or the other may be used, but both should not be used on the same mast."

"Resolved: That no lights, markers or signs, other than those provided in the requisites, should be placed on the highway crossing signal which has been adopted as recommended practice for indicating the approach of trains, except the standard highway crossing sign, which, under the requisites, is to be mounted on the same mast."

Action recommended: acceptance for submission to letter ballot.

The following resolution was also approved for presentation at the annual meeting:

"Resolved: That the Signal section recommend to the A.R.A. _____, that serious consideration be given to the preparation of a leaflet illustrating the approved highway crossing signals which will be placed in the hands of state officials for delivery to automobile drivers when they receive their license."

This resolution shows a blank as at the time it was not known to what committee of the A.R.A. this should be referred.

The object of this resolution is self-evident. Thousands of pamphlets are issued annually by the railroads in the "Cross Crossings Cautiously" campaign. These have been prepared by the American Railway Association. They contain much useful information. The one issued in 1926, by some of the railroads, had pictures of wig-wags and flashing lights. These were placed in the hands of automobile associations and distributed through various channels. However, it is undoubtedly a fact that a very considerable number of motor vehicle drivers did not receive these pamphlets.

In most of the states it is illegal for a person to operate a motor vehicle unless he has a driver's license, and it is illegal to operate a motor vehicle unless it is licensed.

Therefore, if the railroads in each state would appoint a committee to canvass the situation and illustrate the various signals and signs in use in such state, with the meaning of each, in the form of a leaflet, and if the licensing authorities could be prevailed upon to distribute these with the licenses for all drivers or vehicles, assurance would be given that each operator had received this information at least as to his own state. Those licensed in two states would have additional information; in short, the people who should have this information would get it.

If this movement could be carried out, this committee would be able in a few years to collect the various state leaflets, codify them, and perhaps eventually (especially if the A.R.A. is successful in its efforts for standardization, thereby eliminating a number of the aspects now displayed) prepare a small leaflet covering the United States and Canada, which could be issued eventually by all the licensing bodies instead of their issuing those covering state-wide conditions.

The committee recommends that this resolution read as follows:

Resolved: That the Signal section recommend to the Committee on Grade Crossing Protection and Trespassing of the Operating division, A.R.A., that serious consideration be given to the preparation of a leaflet illustrating the approved highway crossing signals to be placed in the hands of state officials for delivery with each automobile driver's license.

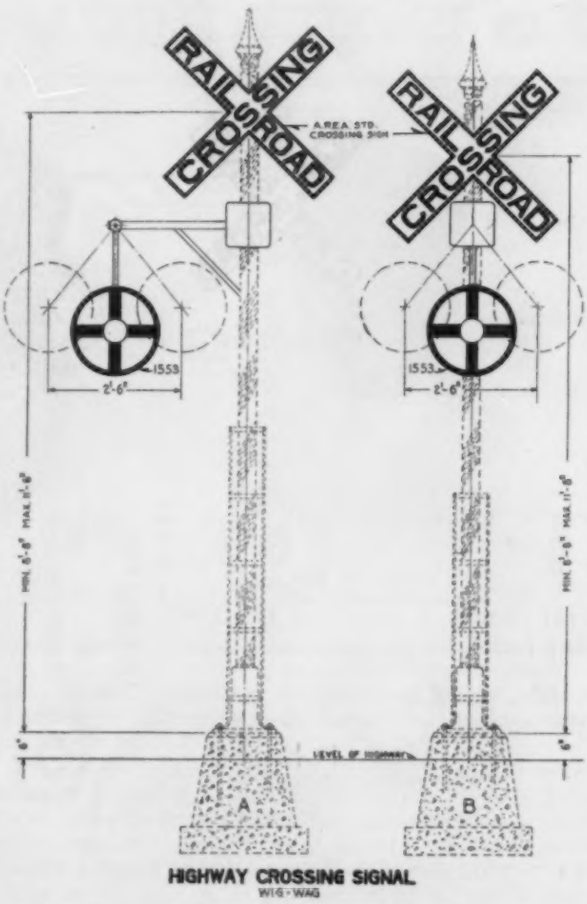
Action recommended: approval and submission to the Committee of Direction of the Signal section for action.

At the 1926 stated meeting the following resolution was also referred to this committee:

"Whereas, A movement has been started to bring before the various state legislatures and provincial parliaments of United States and Canada, to have the highway illuminated by the different state highway commissions.

"The Signal section of the American Railway Association believe that it will be a big help for safety, providing the unit used shall be so safeguarded that no interference will be caused which might be injurious to railroad operation and do hereby approve and endorse the state highway lighting movement provided that said precautions are taken, the same to be submitted for the approval of the highway crossing protection committee of the Signal section of the American Railway Association."

It is the opinion of the committee that illumination of highways by different state highway commissions is not a proposition requiring the endorsement of the Signal section or in fact any action on its part as to the illumination or non-illumination of such highways, or as to the methods of such illumination, except insofar as it might lessen the visibility of the signals which are the recommended standard of the American Railway Association, and, if official action were taken, it should be to the effect that where state highways are illuminated, the lights should be so designated as not to interfere with the highway crossing signals approved by the A.R.A. or be injurious to railroad operation.



A. R. A. Sig. Sec. 1547A—Highway Crossing Wig-Wag Signal

R. H. Aishton, president of the American Railway Association, advised late in November that a conference will be called in Chicago by the Highway Development Association of California, Senator Roy Fellon, secretary, for the purpose of discussing highway lighting and having particular reference to the height and position of highway lights where they parallel the railways, in order to get the viewpoint of the railroads as to the location of these lights, so as not to find out later that they had made a mistake and had not properly considered this feature. He, therefore, requested the secretaries of the Operating, Signal, Safety and Mechanical divisions to designate a member who was convenient to Chicago and who could on call of the chairman assemble and intelligently discuss the subject with the Highway Development Association of California. J. A. Peabody, a member of the Special Committee on Highway Crossing Protection, has been designated to rep-

resent the Signal section, consulting with H. G. Morgan and H. H. Orr.

It is quite possible that the committee will be able to present a supplemental report at the 1927 annual meeting.

Action recommended: acceptance as information.

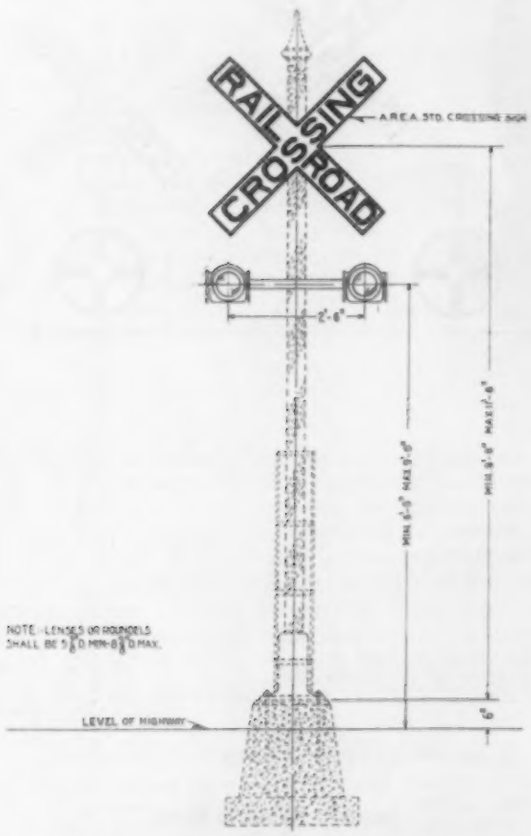
Report on Federal and State Activities

The committee had nothing to add to its report made at the 1926 stated meeting, printed on pages 37 and 38 of the advance notice of said meeting, except as indicated in the preceding paragraphs.

Co-operative Report—American Engineering Standards Committee Code on Colors for Traffic Signals

A. H. Rudd, representative; W. J. Eck, alternate.

The committee reported to the 1926 stated meeting as follows: "The code on colors for traffic signals was approved by the sectional committee and by two of the sponsors, namely, the National Safety Council and the Bureau of Standards. The third sponsor, the American Association of State Highway Officials, has not yet advised as to their action. The American Engineering Standards Committee will not take action to approve the code until all reports are received."


RAIL ROAD CROSSING
A.R.E.A. STD. CROSSING SIGN
2'-6"
MIN. 8'-0" MAX. 9'-0"
MIN. 9'-0" MAX. 11'-0"
NOTE - LENSES OR ROUNDELS SHALL BE 5" O. MIN-8" O. MAX.
LEVEL OF HIGHWAY
6'-0"

A. R. A. Sig. Sec. 1546A—Highway Crossing Flashing Light Signal

We are advised that negotiations are now under way between the committee of the American Association of State Highway Officials and the Sectional Committee on Code on Colors for Traffic Signals, in an attempt to harmonize the difference between them, in order that the former associations may, as a sponsor, approve the work of the sectional committee and pave the way for the adoption of its report. It is hoped that a supplemental report may be presented at the annual meeting.

Action recommended: acceptance as information.

Committee: A. H. Rudd (Penna.), chairman; T. S. Stevens (A. T. & S. F.), vice-chairman; W. J. Eck (Sou.), A. R. Fugina (L. & N.), C. R. Hodgdon (C. P.), C. J. Kelloway (A. C. L.), H. W. Lewis (L. V.), A. H. McKeen (U. P.), H. G. Morgan (I. C.), C. H. Morrison (N. Y. N. H. & H.), H. H. Orr (C. & E. I.), F. P. Patenall (B. & O.), J. A. Peabody (C. & N. W.), J. E. Saunders (D. L. & W.), W. Y. Scott (B. & M.), C. F. Stoltz (C. C. C. & St. L.), C. H. Tillett (C. N.), and E. P. Weatherby (T. P.).

Discussion

Chairman A. H. Rudd (Penna.): Referring to drawing A. R. A. Sig. Sec. 1546A is submitted for acceptance for submission to letter ballot. [*Motion was carried.*]

Chairman Rudd: Drawing A. R. A. 1547A with the dimensions eliminated is submitted for acceptance for submission to letter ballot. [*Motion was carried.*]

Chairman Rudd: The resolutions previously presented at annual or stated meetings are submitted for acceptance for submission to letter ballot. [*Motion was carried.*]

Chairman Rudd: The resolution in respect to the delivery of instruction leaflets to automobile drivers with their state licenses is submitted for approval and submission to the Committee of Direction of the Signal Section for action. [*Motion was carried.*]

Chairman Rudd: The New England states, with the exceptions of Maine and New York, by agreement with the Public Utilities Commission have approved the A. R. A. standard flashing light at highway crossings. The Public Service Commissions of Pennsylvania and New Jersey have approved the flashing-light. The Public Service Commission of the State of California has not approved the A. R. A. Signal section standard, but has approved as standard the wig-wag with the red disc. Generally throughout the United States the acceptance of our recommended standard, either the wig-wag or the horizontal flashing light, is rapidly going on. In Ohio and Illinois either is approved. We are gradually getting to one of the two standards. The three aspect wig-wag has been adopted by the Dominion of Canada.

In Pennsylvania the Public Service Commission and the Highway Commission agree that the flashing signals should be on the right-hand side of the road or the left-hand, never in the middle, and if the conditions are such that they can not be located on the right-hand side, that they be suspended. In New Jersey, the Commission favors putting the signals in the middle of the highway, and the Highway Department has refused permission, so that in borough or cities the signals are placed in the center of the highway, and outside, where the State Highway Commission has jurisdiction, they are placed on the right-hand side. In New York there is practically the same situation.

The proposition of having a crossing watchman operate the crossing lights at four or five crossings is very attractive.

A Common Form of Competition. Concrete Highway Paralleling the Chicago, Rock Island & Pacific

Signal Section Elects New Officers

Committee of tellers reported at close of session yesterday—
Charles H. Tillett, Canadian National,
chairman-elect

JUST before the adjournment of the afternoon session yesterday, Secretary Balliet presented the report of the Election Tellers naming the officers of the Signal section, A. R. A., elected for the coming year as follows:

Chairman, Charles H. Tillett, signal engineer Central region, Canadian National, Toronto, Ont.

First vice-chairman, Carl F. Stoltz, signal engineer, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio.

Second vice-chairman, H. W. Lewis, signal engineer, Lehigh Valley, Bethlehem, Pa.

Secretary-Treasurer, H. S. Balliet, train control engineer, New York Central, New York (re-elected).

In addition to the chairman and the first and second vice-chairman, the new Committee of Direction includes J. E. Saunders, signal engineer, Delaware, Lackawanna & Western; L. Wyant, signal engineer, Chicago, Rock Island & Pacific; W. M. Post, assistant chief signal engineer, Pennsylvania; W. E. Boland, signal engineer, Southern Pacific; G. W. Chappell, assistant signal engineer, New York, New Haven & Hartford; G. H. Dryden, assistant signal engineer, Baltimore & Ohio; W. M. Vandersluis, electrical engineer, Chicago Terminal Improvement, Illinois Central; A. H. Rice, signal engineer, Delaware & Hudson; H. G. Morgan, signal engineer, Illinois Central; H. H. Orr, signal engineer, Chicago & Eastern Illinois, and F. W. Bender, signal engineer, Central Railroad of New Jersey.

C. F. Stoltz
First Vice-Chairman

C. H. Tillett
Chairman

H. W. Lewis
Second Vice-Chairman

Charles H. Tillett

For the first time in the history of the Signal section, A. R. A., or its predecessor, the Railway Signal Association, a resident of Canada has been elected presiding officer. The election of Charles H. Tillett (Canadian National) as chairman of the Signal section brings to this position a man who has had extensive experience in the construction and maintenance of signaling in the United States as well as in Canada. Mr. Tillett is one of the comparatively younger members of the Signal association who have come to the front in the administrative affairs of the association during the last few years. He was elected as a member of the Committee of Direction at the annual meeting in 1925 and was elected second vice-chairman in 1926.

His friends know Mr. Tillett as a rather quiet man of moderate habits. In his college days he won honors for his school, Purdue university, as a half-mile runner and continuing his training habits, he never smoked until recently. His one hobby, if it may be so classed, is his family, as he seeks little recreation in which his wife and boy cannot participate. One of his principal methods of relaxation is to drive his car and he is always ready to show visitors the interesting features of his home city, Toronto.

Mr. Tillett is one of the progressive leaders of the signal field, being a keen student of the economics of signaling in train operation. He has been one of the few to pioneer in the design and installation of so-called automatic interlockings at railroad grade crossings. Likewise his interests in the automatic highway crossing protection problems is demonstrated by the fact that he designed an electrically controlled and operated highway crossing gate, a number of which have been installed.

Although not a native born Canadian, Mr. Tillett has lived in that country for about fourteen years and in that time he has become so interested in the rail-

way and civic affairs of Canada that he is indeed a Canadian; in fact he reveals his nativity in only one case, for any Hoosier must propound on the merits of his native state at times.

Mr. Tillett was born at Peru, Ind., in December, 1884. Following graduation from Purdue university in 1907, he first entered railway service with the Pittsburgh, Ft. Wayne & Chicago (Pennsylvania Lines West), being employed in construction of mechanical and electrical signal equipment. In April, 1908, he went with the Great Northern on the construction of interlocking plants near Seattle, Wash., and in December of the same year he was appointed signal repairman on the Cascade division.

While on the Pennsylvania and Great Northern, Mr. Tillett was determined that the fact that he was a college graduate was not going to prevent him from securing practical experience. Therefore, he kept his sheepskin stored in the bottom of his trunk and none of the men with whom he worked knew that he was a college man until after he was gone.

Leaving the Great Northern in February, 1910, he was appointed signal inspector on the Chicago & Eastern Illinois with headquarters in Chicago. After three years he left the United States and accepted a position as signal inspector on the Grand Trunk with headquarters at Montreal, and since that time has been a resident of Canada.

In September, 1910, he was promoted to supervisor of signals of the Eastern lines of the Grand Trunk with the same headquarters, and in August, 1918, was promoted to electrical engineer of the signal department. In January, 1919, Mr. Tillett was appointed acting signal engineer of the Grand Trunk with headquarters at Montreal, and in the latter part of that year was promoted to signal engineer with the same headquarters. At the time of the consolidation of the various roads in the Canadian National System, Mr. Tillett was appointed to his present position as signal engineer of the Central region, which includes all of the old Grand Trunk of Canada, and considerable mileage of the Canadian Northern and Canadian Government railways.

In addition to his work in the Signal section, Mr. Tillett is also an active member of Committee XII—Rules and Organization of the American Railway Engineering Association; and a member of the Special Committee on Grade Crossing Protection and Trespassing, Division I—Operating, A. R. A.

Record Registration of Signal Section Reaches 751

A TOTAL of 74 members and 43 guests registered at the second day's session of the annual convention of the Signal section, A. R. A., at the Palmer House. With the registration of 644 yesterday this brings the total to 751, the largest registration of any meeting of this association, exceeding the previous maximum established two years ago when 680 were in attendance.

Representative Members

Bentley, R. S., sig. supvr., C. M. & St. P., Terre Haute, Ind.
Black, E. A., sig. supvr., N. Y. C., Ashtabula, O.
Boles, O. K., supvr. tel. & sigs., Penna., Richmond, Ind.
Bortle, R., asst. engr., N. Y. C., Albany, N. Y.
Brown, F. C., sig. inspr., I. C., Chicago.
Chevalier, H. W., chf. drafts., C. M. & St. P., Milwaukee, Wis.
Dawson, W. A., sig. supvr., N. Y. C., Ashtabula, O.
Deming, J. H., sig. supvr., C. of Ga., Macon, Ga.
Dryden, H. M., sig. supvr., B. & O., Dayton, O.
Finch, J. C., sig. inspr., M. P., St. Louis, Mo.
Ford, F. A., supvr. sigs., C. & O., Clifton Forge, Va.
Gage, P. W., sig. supvr., C. B. & Q., LaCrosse, Wis.
Goddard, E. E., supvr. sigs., Carbondale, Ill.
Greenwood, A. L., sig. supvr., L. & N., Jackson, Ky.
Hall, J. K., supvr. sigs., N. & W., Lynchburg, Va.
Hanna, J. V., chf. engr., Kan. City Term., Kansas City, Mo.
Harding, H. H., sig. supvr., B. & O., Newark, O.
Hull, S. P., sig. supvr., N. Y. C., New York.
Hyatt, T. G., sig. supvr., Wabash, St. Louis, Mo.
Irwin, J. C., val. engr., B. & A., Boston, Mass.
Kearton, T. H., gen. sig. inspr., C. G. W., Chicago.
Keers, C. B., sig. supvr., A. T. & S. F., Chillicothe, Ill.
Kinney, F. E., sig. supvr., C. R. I. & P., Cedar Rapids, Ia.
Kipp, W. E., sig. supvr., C. & O., Covington, Ky.
Klaas, E., supvr. tel. & sigs., C. G. W., Dubuque, Ia.
Kunker, J. W., sig. supvr., B. & O., Cincinnati, O.
Lambert, P. E., sig. supvr., C. & N. W., Chicago.
Lanier, H., sig. inspr., Wabash, Decatur, Ill.
Lindsey, E. R., sig. supvr., C. & E. I., Evansville, Ind.
Mansfield, C. C., asst. sig. supvr., C. & N. W., Boone, Ia.
Molloy, J. H., asst. engr., C. R. I. & P., Chicago.
Porter, H. T., chf. engr., B. & L. E., Greenville, Pa.
Ramsey, T. B., sig. inspr., C. & O., Huntington, W. Va.
Rhymer, S. U., supt. tel. & sig. engr., C. & A., Bloomington, Ill.
Schindler, G. C., chf. drafts., C. & N. W., Chicago.
Scott, H. S., gen. for. constr., I. C., Chicago.
Scott, T. W., sig. supvr., B. & O., Connellsville, Pa.
Selke, F. A., sig. supvr., C. I. & L., Lafayette, Ind.
Sheckler, L. I., supvr. tel. & sigs., C. G. W., Mason City, Ia.
Sheets, R. A., asst. engr. train control, C. & N. W., Chicago.
Shepard, A. L., sig. inspr., N. Y. C. & St. L., Cleveland, O.
Snowden, Wm., supvr. tel. & sigs., C. G. W., Marshalltown, Ia.
Stansel, W. G., sig. inspr., I. C., Chicago.
Stradling, E. G., supt. tel. & sigs., C. I. & L., Lafayette, Ind.
Swanson, W. W., sig. inspr., C. B. & Q., Chicago.
Wakeman, K. F., sig. supvr., N. Y. C., Ashtabula, O.
Waltz, E. L., supvr. tel. & sigs., C. G. W., St. Paul, Minn.
Wells, F. L., sig. supvr., C. & N. W., Chicago.
Werthmuller, L. S., asst. engr., M. P., St. Louis, Mo.
Whitehorn, A. R., asst. engr., I. C., Chicago.
Williams, E. S., gen. sig. inspr., L. & N., Louisville, Ky.

Railroad Affiliated Members

Burrell, C. F., engr., M. of W., K. & I. Term., Louisville, Ky.
Clay, D. M., gen. for. of constr., Kan. City Term., Kansas City, Mo.
Davidson, W. N., sig. inspr., B. & O., Garrett, Ind.
DeLozier, F. W., sig. maintr., B. & O., Connellsville, Pa.
Immekus, Car, asst. chf. drafts., I. C., Chicago.
Lamberton, H. C., drafts., M. P., St. Louis, Mo.
Pearson, E. N., sig. drafts., G. T. W., Detroit, Mich.
Perrell, R. T., div. sig. maintr., B. & O., Confluence, Pa.
Reynolds, Raymond, asst. sig. maintr., B. & O., Confluence, Pa.
Sproul, W. B., sig. maintr., B. & O., Hyndman, Pa.

Affiliated Members

Anderson, A. S., gen. sales mgr., Adams & Westlake Co., Chicago.
Blackmore, G. A., v.-p. & g. m., Union Switch & Signal Co., Swissdale, Pa.
Booth, W. W., salesman, Crouse-Hinds Co., Chicago.
Condit, E. A., Jr., v.-p. sales, The Rail Joint Co., New York.
Dunleavy, J. J., salesman & engr., Ward Leonard Electric Co., Mt. Vernon, N. Y.
Field, O. S., ch. engr., General Railway Signal Products Co., Inc., Albany, N. Y.
Folk, H. S. C., sales engr., Electric Storage Battery Co., New York.
Franklin, H., sig. engr., Iowa Railroad Com., Des Moines, Ia.
Gaunt, G. S., service engr., Waterbury Battery Co., Waterbury, Conn.
Granzow, E. F., sales engr., Crouse-Hinds Co., Chicago.
Hayes, S. W., pres., Hayes Track Appliance Co., Richmond, Ind.
Kenrick, R. S., asso. editor, "Railway Signaling," Chicago.
Parish, Preston, mgr., Line Material Div., E. A. Lundy Co., Chicago.
Stallknecht, F. S., sales engr., Primary Battery Div., Thomas A. Edison, Inc., Bloomfield, N. J.
Stone, E. W., train control engr., National Safety Appliance Co., Chicago.
Williams, P. P., sales rep., T. Geo. Stiles Co., New York.

Guests

Anderson, Irving, div. engr., A. T. & S. F., Kansas City, Mo.
Anderson, J. C., const. eng., National Safety Appliance Co., Chicago.

Bangut, Paul, sig. insp., Wabash, Decatur, Ill.
Beck, Edward, elec. eng., Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.
Brock, M., asst. sig. supvr., Southern, Lexington, Ky.
Caron, A. L., sig for., B. & O., Akron, O.
Cooper, J. E., sig. draftsman, H. V., Columbus, O.
DeChant, W. H., rep., L. S. Brach Manufacturing Co., Newark, N. J.
Donahue, T. F., gen. supvr., B. & O., Pittsburgh, Pa.
Ewing, R. H., sales eng., E. A. Lundy Co., Louisville, Ky.
Fendor, E. F., for., L. & N., Louisville, Ky.
Field, O. S., ch. eng., G. R. S. Products Co., Albany, N. Y.
Fines, Fred, signalman, Penna., Indianapolis, Ind.
Gacher, C. E., asst. eng., M. P., St. Louis, Mo.
Gault, H. H., asst. sig. supvr., B. & O., Akron, O.
Gibbons, J. M., ch. clerk, L. V., Bethlehem, Pa.
Glano, I. C., sig. maintainer, C. & O., Campbell, Va.
Harding, E. J., signalman, Erie, Alden, N. Y.
Hattery, Charles, assist. sig. supvr., C. R. I. & P., Fairbury, Neb.
Kelly, J. B., gen., roadmaster, M. St. P. & S. S. M., Minneapolis, Minn.
Kempe, E., supvr. train control, M. P., Osawotomie, Kan.
Larkin, F. D., div. eng., Erie, Meadville, Pa.
Law, J. C., signalman, A. T. & S. F., La Junta, Colo.
Lightfoot, L. L., dis. asst. supvr. signals, N. Y. C., Toledo, O.
Lincoln, E. W., sales eng., Fansteel Products Co., North Chicago, Ill.
Lollis, B. F., asst. sig. eng., C. B. & Q., Chicago.
Loss, F. J., sig. insp., M. C., Detroit, Mich.
Marsh, H., ch. eng., Manufacturers Railway Co., St. Louis, Mo.
Paulins, A. H., sig. maintainer, C. G. W., Hampton, Ia.
Pickett. H. G., gen. sig. insp., F. E. C., St Augustine, Fla.
Po-Tao Yuan, student eng., General Railway Signal Co., Rochester, N. Y.
Post, Fred, sig. maintainer, Erie, Cornell, N. Y.
Shatwell, E. V., sig. supvr., C. & N. W., Chicago.
Thomas, R. A., signalman, Erie, Warren, O.
Tomlinson, R. C., t. & t. insp., Penna., Indianapolis, Ind.
Thompkins, O. S., sig. supvr., C. & N. W., Boone, Ia.
Thompson, M. D., asst. eng., I. C., Chicago.
Tillotson, G. E., maint. for., Erie, Warren, O.
Turner, R. S., sig. supvr. U. P., Omaha, Neb.
Wendt, E. F., consulting eng., Washington, D. C.
Whiting, C. L. supt. of terms., C. M. & St. P., Chicago.
Wilson, E. C., v-p., National Railway Signal Co., Boston, Mass.
Yarbrough, L. B., signalman, Wabash, Decatur, Ill.

Annual Meeting of the Signal Appliance Association

THE annual meeting of the Signal Appliance Association was held yesterday in the Palmer House. Frank W. Edwards, secretary-treasurer, made a full report of the membership and finances and gave a brief resume of the preliminary arrangements made for the next meeting in Montreal in September.

The following resolution was adopted:

"Resolved that we extend to A. H. Rudd, a charter member of the Signal section, our sincere and hearty congratulations on the occasion of his sixtieth birthday; may he live long, enjoy good health, prosper and continue to render his invaluable counsel for the development of railway signaling in the future as he has in the past."

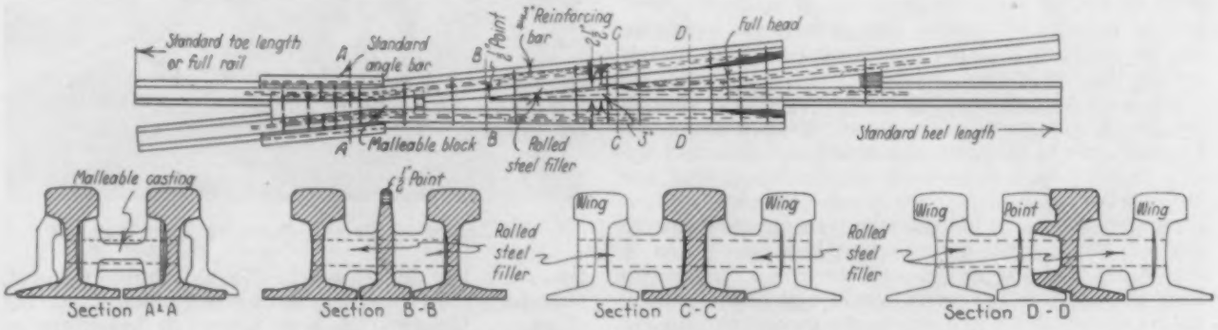
A resolution was also adopted extending the appreciation of the association to Harry W. Renick for the unusual service he rendered at the Los Angeles meeting. It was stated that with a few exceptions, the members were unaware of the tremendous amount of time and energy Mr. Renick devoted to the arrangements with the result that this meeting will long stand as a memorial in the history of the association.

The following officers were elected: Chairman, G. A. Nelson, Waterbury Battery Co.; Vice-Chairman, R. E. Trout, Thomas A. Edison, Inc.; Secretary-Treasurer, F. W. Edmunds, Craft, Inc. Members of Executive committee, T. J. Crowley, Handlan Buck Manufacturing Co.; F. F. Seeberger, Ohio Brass Co., and Harry W. Renick, Magnetic Signal Co. Walter P. Allen, Union Switch & Signal Co., retiring chairman, becomes the honorary member of the Executive committee. The chairman appointed W. M. Manuel, Corning Glass Works, chairman of the Arrangement committee and W. R. Collins, Maloney Oil Manufacturing Co., chairman of the Place Committee.

An Articulated Manganese Insert Frog

A NEW design of rail-bound manganese frog has been developed by the Louisville Frog & Switch Company, Louisville, Ky., in which the manganese insert is made in three separate portions, two for the wing rails and one for the point, thus permitting any part to be replaced when it becomes worn, without discarding the parts that are still serviceable. The construction of the frog, which is of the bolted design, is shown in the accompanying plan and sections of the parts.

Besides the economy in renewing worn parts this frog is said to be as resilient as an ordinary bolted rigid frog and has not the rigidity which is sometimes raised as an objection to solid manganese frogs or railbound frogs in which the manganese insert is formed of one piece. Due to the short toe length required, the frog is well adapted to layouts where solid manganese frogs have been used or, if desired, rails can be added to provide toe and heel lengths to conform to the standards of the various railroads. The manganese wings extend back a sufficient distance so that they will not bear on the short carbon



Plan and Sections of the New Insert Frog

steel wing rail. All materials in the frog are selected for the service demanded of them and the bolts are of high carbon, heat-treated steel, with high tensile strength.

The New Buda No. 119 Motor Car

THE Buda Company, Harvey, Ill., has designed a new motor car chassis for heavy duty service, on which the purchaser may install a suitable body to accommodate 12 or more persons, for transporting extra gangs; or for hauling materials for track gangs or other maintenance forces, thus serving as a light work train. The car is also well adapted for hauling car riders back to the hump in classification yards.

The frame is built up of heavy steel channels, mounted on semi-elliptical springs. The wheels are of

Chassis of the New Buda No. 119 Motor Car

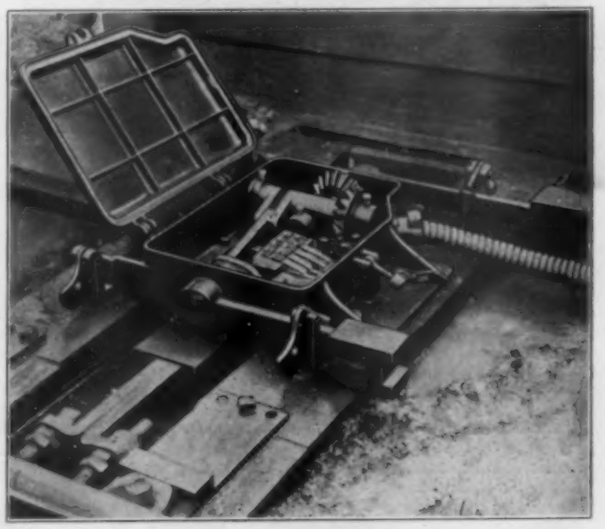
cast steel, with heat-treated axles of large diameter, mounted on roller bearings having pedestals designed to take care of sidesway and thrust.

The power plant is a Buda four-cylinder, water-coiled unit of 12 hp. The clutch is of the multiple-disc type with a three-speed sliding transmission. The final drive to the rear axle is by means of a heavy roller chain and sprocket. The car is equipped with a reverse gear, permitting it to operate in either direction. The reverse gear is a separate unit from both the engine and transmission and is connected to the later by a flexible coupling.

Power Switch Selector Increases Flexibility

THE dual control selector which has been introduced by the General Railway Signal Company combines the advantages of the power-operated, remotely-controlled switch with that of the hand-operated switch, in a simple manner. The dual control selector includes two levers. One changes the connection of the switch-rod from the switch-machine throw-rod to the hand-throw lever or vice versa, while the other lever throws the switch manually in a manner familiar to trainmen. The former lever is located on the track side of the selector box and performs its function by shifting a dog which engages transverse slots cut into the hand-throw control rod, the switch rod and the power rod from the machine. In one position this dog effects a positive connection between the hand-throw rod and the switch rod but when the selector lever is thrown to the switch machine position (marked on the cover) this dog connects the power machine rod to the switch rod.

Provision is made to disconnect energy from the switch machine and place the signals at the stop position automatically. The switch is never disconnected, being connected either to the switch-machine or to the



A Switch May Be Operated Either Manually or by a Power Machine Wherever the G-R-S Dual Control Selector is Installed

hand-throw lever. The G-R-S dual control selector is especially convenient for local freight switching and will give additional flexibility to remotely-controlled power-operated switches.

The Improved Durable Bumping Post

GRANTING that a bumping post will perform its desired function of stopping cars, the question of its economy hinges largely on two things; the cost of installation and the cost of main-

The Improved Durable Bumping Post Installed

tenance. The design of the Durable bumping post, manufactured by the Mechanical Manufacturing Company, Chicago, has been improved and strengthened by the use of a heavy forged steel spreader bar

at the point where the bumping post rails join the rails of the track. A heavy clamp now fits over the top of the spreader bar, the ends being bent down so that they overlap the sides of the tie, to which they are attached by either spikes or lag screws. The clamp and the heavy section of the bar prevent the buckling of the bar and the pulling together of the rails in case the post should receive an unusually heavy shock from moving cars, and thus reduce maintenance costs.

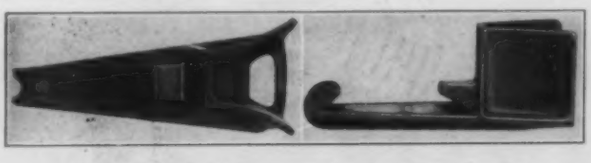
A Simple Tie Spacer

THE Duff Manufacturing Company, Pittsburgh, Pa., has placed on the market a tie spacer which is simple in operation and which adds little either to the bulk or the weight of the track gang's quota of tools. The device consists of a single cast steel arm, one end of which carries a projection

The Duff Tie Spacer in Operation

with a socket into which the head of a track jack may be fitted while the other end is fitted with lugs with which the arm may be applied quickly to the base of the rail. The lugs are so arranged that the pressure of the jack causes them to grip the rail firmly without slipping.

After the arm is fastened to the rail the jack is run out until the head has a bearing against the arm and the base is against the side of the tie to be moved, when further operation of the jack shifts the



Top and Side Views of the Duff Tie Spacer

tie to its desired position, without injury to the tie as is occasioned by the use of sledges for forcing the tie from its original position. After the tie has been moved the arm can be removed from the rail as quickly as it was applied. The arm weighs 13 lbs. and can be used with any make of track jack.

A Pneumatic Tool for Spike Driving

A NEW idea in labor saving is to be seen in the pneumatic spike driver placed on the market by the Ingersoll-Rand Co., New York. The novelty lies in the application rather than in the device itself, as the spike driver is essentially an adaptation of the pavement breaker which the company has been manufacturing for several years. The machine has been adapted to spike driving by providing it with a new form of head, so that instead of providing the means

How the Spike Driver Is Used

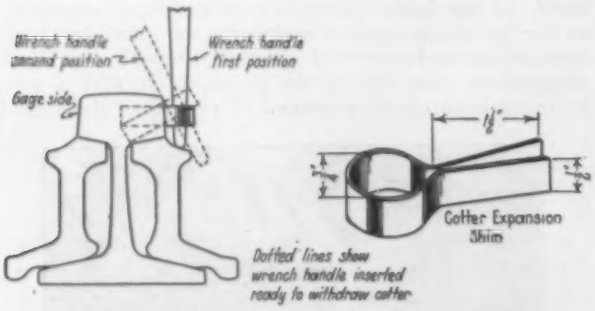
for attaching a bit, the head accommodates a hardened steel button by means of which the impact is delivered to the head of the track spike at the rate of about 1,200 to 1,500 blows per minute.

The weight of the hammer is 65 lb., which is of advantage in handling the tool during the time that the spike is being driven since the entire weight is then resting on the spike. Therefore, the only time that the laborer is required to lift the tool is when he moves it from one spike to the next. In employing this tool in rail renewals it has been found best to use two of them, one on each side of the rail, thus making it unnecessary to lift the driver from one side of the rail to the other. The only hand work necessary is to start the spikes in advance and repeated tests show that the driver will set a spike in 3 sec., whereas careful timing of hand driving shows that the average time necessary to drive a spike with an ordinary maul is 14 sec. These spike drivers have been in use for some time on the Delaware,

Lackawanna & Western and are now being subjected to test on the Chicago & North Western, the Baltimore & Ohio and the Pennsylvania.

The Cotter Expansion Shim

A NEW expansion shim for rail laying has been put on the market by the American Nut & Bolt Fastener Company, Pittsburgh, Pa., under the name of the cotter expansion shim. This shim was invented and patented by Hunter McDonald, chief engineer of the Nashville, Chattanooga & St. Louis, and, as the name indicates, it has the form of a cotter key. The primary object of the new form, as shown in the drawing, is to facilitate prompt removal from between rail ends after the bolts have been tightened, the loop being made of a suitable size to receive the pointed end of a track wrench for prying the shim out of the joint.



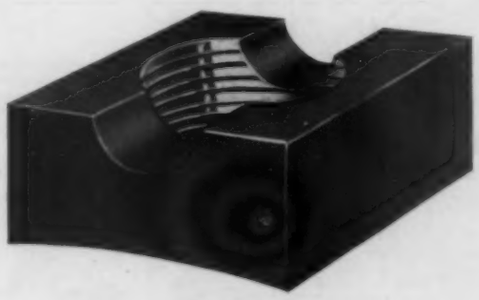
The Cotter Expansion Shim and the Manner in Which it is Removed From the Joint

These shims are made of American Steel & Wire Company flat wire ½ in. wide, No. 2 temper, with a bright finish. Four thicknesses of this wire are used in making the shims, namely, $\frac{1}{16}$ in., $\frac{3}{32}$ in., ⅛ in., and $\frac{5}{32}$ in., thus providing shims ⅛ in., $\frac{3}{16}$ in., ¼ in., and $\frac{7}{16}$ in. in thicknesses. Where allowances for expansion greater than $\frac{7}{16}$ in. are desired, fillers are provided for insertion between the two leaves of the shim to make up greater thicknesses. These fillers are provided in thicknesses of $\frac{1}{16}$, ⅛ and $\frac{3}{16}$ in., thus making it possible to provide expansion clearances ranging from ⅛ in. to ½ in., in variations of $\frac{1}{16}$ in. These shims have been subject to thorough tests on the Nashville, Chattanooga & St. Louis, where it has been found that they can be used seven or eight times before being seriously injured.

The New Speed Unit Lock Nut

A NEW self-adjusting unit lock nut designed to provide ease and speed in application and maximum tension as well as security of bolted parts has been developed and placed on the market by the MacLean-Fog Lock Nut Company, Chicago. This nut is designated as the Speed Unit from the rapidity with which it is said that it can be applied and from the fact that it is complete in itself, requiring no secondary unit.

It is said that these nuts may be applied as easily and quickly as any free fitting nut of the ordinary type, since there is no locking friction of any kind until the unit nut is wrenched home, this operation producing tension in the bolt and locking the nut securely. It is also said that the nuts adjust themselves automatically to the bolts and that the variable dimensions which are inherent in commercial bolts, especially those that have been re-cut, have no effect on the efficiency of this lock nut. These nuts are used on frogs and crossings with heat-treated bolts and for other purposes where high tension and vibration are encountered.



The New Speed Unit Lock Nut

New Union Pacific Passenger Station at Boise, Idaho